# Better bottom-line benefit/cost analysis for multi-year projects [1]

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'**Benefit/Cost**' is a generic, easily-understood concept, bandied about by many program and project management risk analysis planners. But I've found very few project personnel who actually knew how to do it before they took my **Project Management Fundamentals** seminar. Furthermore, the few that already knew how, did it the 'hard' way; and even then, often incorrectly!

Although it sounds simple, **B/C Analysis** is really quite complicated; replete with assumptions, and entailing formulaic computations of several abstruse variables – *some with meanings that differ from either common usage, or project management baseline-budgeting terminology* -- for indicators to compare versus pre-established criteria! [For instance, in Benefit/Cost terminology, **'Discount Rate'** is the assumed cost (as a percentage) **for borrowing money *in the future***, not a current mark-down or price reduction on a product. Furthermore, **PV = Present Value**, not to be confused with the **PV (Planned Value)** of Earned Value Methodology (EVM). Muddying the issue even more, **FV (Future Value)** is EVM's **Planned Value** for multi-year projects; while **'Financial Internal Rate of Return (FIRR)'** is neither monetary income nor a guaranteed savings rate, but rather an analytical break-even point in Discount Rate percentage terms.] ***Confused already?!*** FYI, the foregoing are all common misconceptions I have encountered on-the-job and in the classroom.

**Consequently, in the normal course of events, Benefit/Cost analysis is the province of specialists; primarily financial managers and esoteric economists.** This presents a dilemma for project planners and managers who – *while not expected to be experts in the subject matter* -- **are responsible for overseeing the analytical process --** but all too often lack the capability to ***participate in it, or verify the analyst's findings*** and be reassured the results were based on **realistic estimates and analyzed objectively**; not simply manipulated to satisfy the bias of one or other contentious stakeholders. And from my extensive experience, **this is not a trivial concern concocted by paranoid project planners and managers.**

Undertaking new ventures requires costly up-front and periodically-recurring capital investments to fund a myriad of risky activities and resources over a long period of time; with the expectation of a worthwhile return on that irretrievable sunken-cost investment in the far-distant future. However, for a variety of reasons, **the history of successful projects is dismal** – not only behind schedule and over budget during the

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implementation stage, but also lacking follow-on operational sustainability for the earlier anticipated life of project, after delivery. ***What is the Cause for this Effect?***[2]

Since economic feasibility up-front is crucial for launching commercial projects, objective realistic estimates and meaningful variables are essential for Benefit/Cost analysis. **Unfortunately, in seeking favorable executive support, sponsorship &/or customer approval, project proponents tend to overlook, ignore or minimize risks, while making unrealistic, optimistic assumptions** -- low-balling costs, and/or inflating revenue estimates to stay within the company's operational budget. Furthermore, while related current costs and revenues – namely **Present Values** -- may be known, all values for the actual implementation phase and remaining life of the project are simply '**ceiling estimates;**' in other words "Guesses." And worse yet, **sometimes these cost and revenue estimates are also budgeted for their life expectancy in terms of their base year monetary values;** ignoring the impact of inflation and other factors on the ultimate outcome.

**To allay these concerns, this article raises the curtain on the mystique**, indicator and variable acronyms for measuring the time-value of money; disperses the formula fog of Benefit/Cost Analysis; outlines the elements and procedural steps for analysis with a simple example, and illustrates three '*Quick & Easy*' templates for project planners and managers to emulate and analyze pertinent data for more realistic, rational '*Go/No Go*' decisions.

While often euphemistically referred to as 'investments,' **most public sector (and charitable) projects and programs are outright expenditures and don't really undergo strict Benefit/Cost Analysis.** Sometimes sector economists attempt to ascribe monetized values for intangibles such as a human life, or a level of education in order to determine the benefits to society in monetary terms. More often than not, programs and projects -- *such as community health facilities and activities; or schools, and education programs* -- are simply deemed desirable social outcomes for target populations. They are therefore usually analyzed in terms of '**Effectiveness/Cost'** rather than **Benefit**/Cost, where the 'benefits' are subjective outcomes of indicators such as '***health status***' or '***literacy level***.' Sector economist experts determine appropriate units and proxy values for the effectiveness variables and related indicators, then the analysis consists of determining the size of the cost per benefit unit. In any event, since the benefits are deemed socially-desirable effects rather than monetary returns, all or most of the monetary costs are borne by the government. The thrust of the analysis is primarily to get the '*biggest bang for the buck*' in order to determine the ***scope of coverage*** within available budget limitations, rather than a "GO/NO GO" decision, and coverage is only

[2] "*Find out the cause of this effect, Or rather say, the cause of this defect. For this effect, defective comes, By cause!*"
***Lord Polonius*** *in* ***Hamlet*** **(by *William Shakespeare*)**

limited by the size of the budget that can be acquired through the political '***want's***' process, rather than objectively-determined '***needs***.'

**Apart from a lack of monetary benefit, another major concern with such public projects is that their project sponsors are extremely myopic. They *only perceive the benefits of their project*, and count *only the direct project costs* in their analysis, *while ignoring -- or dismissing -- any collateral cost to the public at large*.** [These indirect costs are known as '**disbenefits**.'] World-wide government responses to the Covid epidemic are a case in point. Quarantines and vaccination activities were/are focused on curtailing the incidence and impact of the disease, while disbenefits – the devastating economic impact and other side-effects of the drastic lockdowns – were essentially ignored. The push by environmentalists for electrically-charged vehicles to replace fossil fuel-driven ones is another example. While the virtues of lower pollution are touted as benefits, both the source & cost of producing the requisite electricity vs. fossil fuels, as well as the disbenefit on the environment from hazardous wastes (of ultimately-discarded batteries) are ignored, or given short shrift.

Analysis of these types of projects is truly the domain of myriads of sector specialists interacting with dedicated specialist sector economists; to the consternation &/or continuing bewilderment of the dis-benefitted public. While the Benefit/Cost concepts apply, analysis and resolution is beyond the scope of this article.

**Public infrastructure projects such as transportation, and irrigation fall into a pseudo-Benefit/Cost category.** These types of projects incur up-front monetary costs for the government, with user-benefits intended for the public; while some insignificant amount is anticipated to be recovered through user-fees. Short-falls -- as well as on-going operational costs – in such programs and projects are usually significant, and must be heavily subsidized. Sometimes the 'Benefits' are monetized by sector economists with proxy values in terms of the stream of benefits that could flow from their utilization – such as the increased value of trade from the volume of goods or expenditures of passengers that travel over, through or enabled by them; or (in the case of irrigation) the estimated market value of increased crops that could theoretically be produced by their use. Otherwise from the outset, such projects are not viewed as profitable enterprises, but rather as essential expenditures for the public good. So once more, the thrust of the analysis is usually to determine the scope of coverage within available or foreseeable budget limitations, rather than to elicit a "GO/NO GO" decision.

**Another variant (with a collateral concern) is government – *as well as well-meaning NGO organizational* -- agricultural project initiatives to assist small farmers; some of which I have encountered while working in several developing countries.** Up-front costs are borne by the government or NGO **with loans** provided to famers to purchase inputs – such as seeds, fertilizer, pesticides and even equipment -- to boost their productivity and total production. Expected returns to repay the loans are based on

estimates of future 'shadow prices' from the sale of increased crop yields. Unfortunately, supply & demand determine actual market prices which plummet from the increased supply. So, without guaranteed prices and adequate storage facilities to control the flow of the product to the market, early harvesters benefit the most. The remaining farmers hope their competitors will have only a modest harvest to share to meet the demand, or worse – *hope they have crop failures*; while laggards lose, and their crop surpluses rot-in their fields. Consequently, these well-intended programs and projects leave most participants trapped in a vicious cycle -- of debt which they hope to have written-off – *or restructured* – and another season of poverty. Agriculture economists 'rule the roost' planning and analyzing these types of projects; but planners and managers should IMO be more pro-active with collateral or sub-projects, and risk-sharing schemes to alleviate the impact of supply-demand swings on project participants.

## BOTTOM LINE BENEFIT/COST ANALYSIS = SEVEN CONCEPTS + NINE STEPS

Therefore, while the Benefit/Cost analysis language is pertinent, **the scope of this article and example is focused on commercial-type profit-seeking projects**, where the costs are borne by -- and the benefits received (or shared by) -- by the same entity (or entities), in direct monetary units, and the purpose of the analysis is to determine a "GO/NO GO" decision.

## 'Benefit/Cost' Terminology: Seven Key Concepts, & Criteria for Project Selection

1. **Present Value (PV) Costs & Benefits**
   Present Value is the current monetary value of activities, equipment, goods and services at the project's initial – i.e. base -- year. Cost is the anticipated expenditure, and Benefits are the anticipated revenues. For scheduling and budgeting in Earned Value Methodology (EVM) terms, the Present Value for the initial year is also the project's Planned Value (PV). [**NOTES: 1.** For scheduling purposes, the initial year is designated year zero "0." **2. Benefits** are also commonly referred to as **Revenues**.]

2. **Future Value (FV) Costs & Benefits**
   Future Value is the estimated monetary value of activities, equipment, goods and services at all subsequent years, taking into consideration inflation, and any other factors for different rates of individual items. Also, as indicated earlier, for scheduling and budgeting in **Earned Value Methodology (EVM)** terms, **the Future Values for all subsequent years after the initial year are the project's Planned Values (PVs). NOTE:** For scheduling purposes, the second year of the project is designated year one "1."

3. **Discount Rate (DR)**
   As indicated earlier, the Discount Rate is the assumed cost (as a percentage) for borrowing money ***in the project's future*** years. In effect, it is **a reverse compound interest rate**. [**NOTE:** The Discount Rate fluctuates from time to time, based on market forces, and is beyond the control of the project. Thus, a 'Best Case,' 'Most Likely' 'Worst Case' range should be estimated for planning purposes, and revisited periodically during the life of the project. This is the area of expertise of financial managers and economists.]

4. **Net Present Value (NPV)**
   The Net Present Value is the sum of all project Benefits at Present Values minus all project Costs at Present Values. **It is obtained by applying the Discount Rate to all Future Values at different years and converting them back to a common Present Value base.** [How to do this will be outlined in the next section.]

5. **Threshold, or Hurdle Level**
   These terms are synonyms for the desired **Profit**, expressed as **a decimal percentage beyond the 'Break-Even' level in the Benefit/Cost Ratio** – for example 1.15 for **15%.**

6. **Benefit / Cost Ratio (BCR)**
   **This is the Present Value of all Benefits divided by the Present Value of all Costs.** The Break-Even level is equal to one, '1.' A BCR of less than '1' indicates a loss; suggesting a "NO GO" situation (or need for subsidy). Anything greater than '1' indicates a surplus. A notch higher, anything equal or greater than the Threshold (or Hurdle) level indicates a viable "GO" situation.

7. **Financial Internal Rate of Return (FIRR)**
   The FIRR – usually abbreviated IRR -- represents the level of financial return on the investment for a given the Discount Rate. In other words, **the IRR is the Discount Rate at which the Benefit Cost Ratio (BCR) is '1' or Break-Even.** Thus, in order to earn a profit, a desirable Discount Rate for the project should be less than the IRR.

## The 'Nine Step' Application of Benefit/Cost Analysis for Multi-Year Projects

1. **Prepare a Time-Scaled Schedule** for the ***entire anticipated life*** of the Project, including its operational utilization life beyond initial implementation.

2. **Estimate the Costs and/or Benefits – i.e. Revenues -- for Each Activity** in the project in '**Present Value**' terms, and assign them to the activities on the Time-Scaled Schedule.

3. **Estimate Separate Annual Percentage Growth Rates for All Activity Costs and Revenues beyond the Initial Year, including Post-Project Implementation Revenues & Costs.** Contractors implementing projects for other Customer Owners, or Government-sponsored projects are reimbursed for expenses incurred plus a reasonable profit – usually at intervals on a pay-as-you-go basis -- but sometimes only in a 'lump sum' on completion. Government projects thereafter continue to operate on subsidies to close the short-fall from any income derived from on-going project operations. Commercial projects on the other hand are 'For-Profit' ventures. Most Payback to their investors begins after the implementation phase of the project has been completed. However, in addition to any income-generating activities provided by the entity's products and services, Operational & Maintenance (O&M) costs continue to be incurred for the operational life of the project. Thus, the Cost/Benefit analysis must include all anticipated revenues and costs for the <u>total life of the project</u> (LOP) – not just for those incurred during the implementation phase.

   **The formal way** to calculate the 'Future Value' of each item is to **'Ceiling Estimate'** – *i.e. look at the ceiling and guess* -- an appropriate annual **percentage rate increase** for it, for the time period planned. Then apply that rate in the Compound Interest Formula:

$$\mathbf{FV = PV(1 =+ i)^t}$$

   Where: PV = initial 'principal' amount
   1 = a constant '1'
   **'i' = % interest rate (as a decimal)**
   't' = the beginning of the project's year when the cost (FV) will be realized

   [**NOTE**: **A project's initial year is '0',** because interest accrues on the Principal at the <u>end</u> of the year.] For instance, given an item that would cost $100 at the beginning of a project but will be needed at the **seventh** year, with an estimated growth rate of 3% per annum, its **Future Value at the <u>sixth</u> year** of the project – *i.e. 6 years beyond the base year* – for planning the Base Line Budget would be computed as: **$119 at 't' = 6** rather than $123 **at 't' = 7.**

   Since different project cost items usually incur different growth rates, the process should be repeated, and applied individually to all the items throughout the project, scheduled for their respective year(s). **This is a very laborious, time consuming, number-crunching process, and prone to error.**

**<u>For this Step,</u>** my **'<u>Quick & Easy Way</u>'** is to use my **Future Value Planning Template** to estimate the 'Future Value' of Every Cost & Revenue beyond the initial year, as shown

in Figure 1 below. This Excel Template has the compound interest formula embedded so the process is facilitated for up to 100 different items over 30 years. [*The foregoing example is highlighted.*]

**Figure 1: 'Ceiling Estimating' Future Values**

**ESTIMATING FUTURE VALUES (FVs) of VARIOUS 'ITEMS,' ACTIVITIES, *or MILESTONES***

**List below Up to 100 Different items, with PV & Your 'Ceiling Estimate' Growth Rate For Up To Thirty (30) years**

*For EACH TIME PERIOD:* The Compound Interest Formula FV = PV(1+i)^t is applied, where

PV = Initial Amount
1 = Constant ( One )
I = Interest Rate (Decimal)
^t = Time Period (Exponent)

**To facilitate subsequent computations for Planning or rates for Borrowing & Benefit / Cost Analysis**

**To obtain Estimated Future Values for Baseline Budgeting and Analysis, Enter Your Project Data in the Yellow Cells Below**

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| *Annual Growth + (or Discount -) Rate* | | | | *FUTURE VALUES AT YEARS BEYOND THE BASE YEAR* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Items, Activities or Milestones in the Project* | *AGR % for Planning* | *Money Unit* | *Value @ Base Year 0* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | *US$* | | | | | | | | | | |
| EXAMPLE | 3.00 | US$ | 100 | 103 | 106 | 109 | 113 | 116 | 119 | 123 | 127 | 130 |
| A | 1.00 | US$ | 300 | 303 | 306 | 309 | 312 | 315 | 318 | 322 | 325 | 328 |
| B | 2.00 | US$ | 250 | 255 | 260 | 265 | 271 | 276 | 282 | 287 | 293 | 299 |
| C | 4.00 | US$ | 70 | 73 | 76 | 79 | 82 | 85 | 89 | 92 | 96 | 100 |
| D | 5.00 | US$ | 400 | 420 | 441 | 463 | 486 | 511 | 536 | 563 | 591 | 621 |

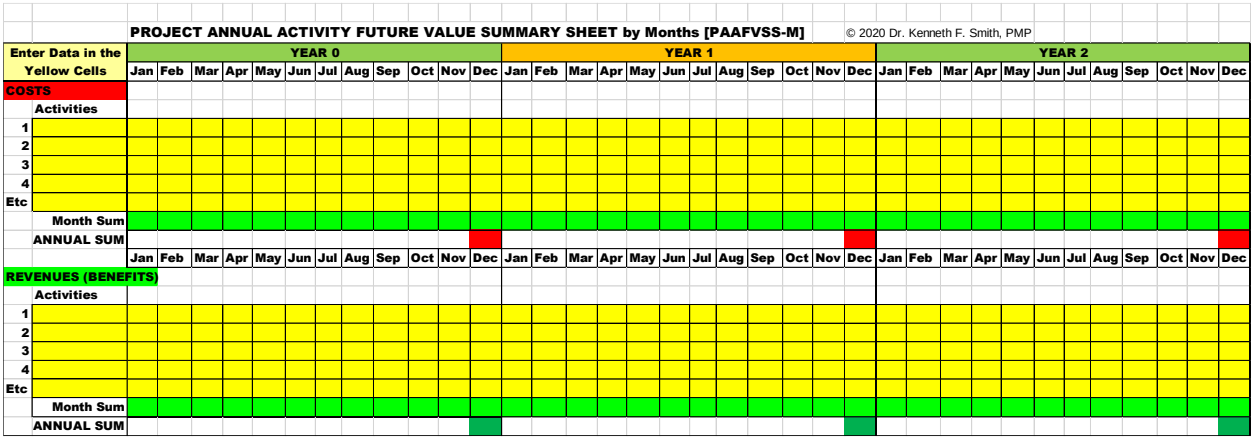
[**NOTE**: In the actual template, you can enter data in yellow cells to obtain the Future Values for all your items. If you have a different situation and different approach – such as preestablished costs at set intervals for some items – for your project components, by all means use it!]

4. **Assign the Future Values to Each Activity in the Time-Scaled Network.**

5. **Summarize the Present Value Monetary Values for the Base Year, and Future Values for all subsequent years from the Time-Scaled Network – BY YEAR -- segregated by Costs and Revenues.** These are the Planned Values for those years.

[See my sample Excel format for an *illustrative* Monthly summary on the following page.]

## Figure 2: Project Annual Activity Future Value Summary Sheet (by Month)



| PROJECT ANNUAL ACTIVITY FUTURE VALUE SUMMARY SHEET by Months [PAAFVSS-M] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| Enter Data in the Yellow Cells | YEAR 0 | | | | | | | | | | | | YEAR 1 | | | | | | | | | | | | YEAR 2 | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| COSTS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Activities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Etc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Month Sum | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANNUAL SUM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| REVENUES (BENEFITS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Activities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Etc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Month Sum | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANNUAL SUM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

6. **Select a 'Best Case,' 'Most Likely' & 'Worst Case' Range of Percentage 'Discount Rates'** for Analysis.

7. **Select a desirable Percentage 'Hurdle Rate' i.e. Profit, Threshold.**

8. **Calculate the Net Present Value (NPV).** Apply the pre-selected **Discount Rates** to each **Annual Summary Future Value** in the foregoing table, in order to convert them to their **Present Values**, given those rates.

   Essentially, this applies a uniform **Discount Rate** to each year's disparate 'ceiling-estimated' Future Values and reverse-engineer's the compound interest rate formula. Thus, for an individual item:

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

Where: FV = Future Value
r = % Discount Rate (as a decimal)
1 = is a constant
t = the project year in which the money is borrowed

[**REMINDER:** Money is usually available for the first year of a project, so again the initial project year is '0' and 't' in the formula should be modified to 't-1.']
For example, given a Future Value (FV) of $879 at a project's fifth year, and an 'r' = 0.1 (i.e. 10%) the Present Value (PV) will be $600 with t = 4, rather than $549 with t = 5

Essentially, you are deriving the Present Values (PVs) of both Costs and Revenues from a variety of items with different Future Values (FVs) from sources at different phases over the life of the project, so they can be comparatively analyzed on a common base.

**After the individual activity values have been reduced from FVs to PVs -- *derived from their respective Cost & Revenue FVs at different time intervals* -- the Project's Net Present Value (NPV) is obtained by subtracting the Cost NPV from the Revenue NPV.**

**NPV = Revenue NPV – Cost NPV**

9. **The Benefit/Cost Ratio (BCR)** is obtained by simply dividing the Net Present Value of all the Benefits by the Net Present Value of all the Costs.

$$\textbf{BCR} = \frac{\textbf{NPV of all Benefits}}{\textbf{NPV of all Costs}}$$

**A BCR of 1.00 is the "*Break-Even*" point, and anything greater represents the profit.** For example, given a $60,000 PV Benefit, and a $40,000 PV Cost

$$\textbf{The BCR} = \frac{\$60{,}000}{\$40{,}000} = \textbf{1.5} \quad \textbf{or a 50\% profit}$$

**Again, my 'Quick & Easy Way" for these remaining Steps** is to **Enter the 'Future Values' of Every Cost & Revenue for each year in my FIRR Template** and Perform **'*Trial & Error*'** to analyze the Combination **for BCR and 'GO/NO' Recommendations.**

A hypothetical project with an estimated stream of income – pre- & post- project completion, at a desired **15% Profit** (i.e. Threshold or Hurdle rate) and summary estimated annual costs -- is shown in my Excel Template in Figure 3 on the following page, analyzed *concurrently* for three potential Discount Rates.

## Figure 3: Integrated Analysis of Future Values (FVs) for Various Costs & Revenues of a Project in order to Determine the Net Present Value (NPV), Internal Rate of Return (IRR) & Benefit Cost Ratio (BCR) at Various Discount Rates

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4.00% | Low DISCOUNT RATE (Best Case) | | | | Discount Rate = Effective Cost of Borrowing/Using Money | | | | |
| 10.00% | Standard DISCOUNT RATE | | | | IRR = | 13.03% | An IRR is the rate at which BCR = 1. The Discount Rate for an Acceptable BCR Threshold should be even less than IRR. | | |
| 13.00% | High DISCOUNT RATE (Worst Case) | | | | @ DISC Rate: | 4.00% | 10.00% | 13.00% | |
| Mill Pesos | CURRENCY | If IRR @ top right = ERR after data | | | NPV = | 17.87 | 4.11 | 0.04 | |
| 0.3 | entry, enter a # at LEFT between 0.1 & 0.9 [T&E] | | | | BCR = | 1.60 | 1.16 | 1.00 | |
| 1.15 | = Acceptable BCR Threshold (i.e. Minimum Profit Level) | | | | Decision: | OK | OK | NO GO | |
| Enter REVENUES below in | | LOOK for RESULTS at UPPER RIGHT | | | Enter COSTS below in YELLOW CELLS | | SEE RESULTS ABOVE | | |
| YELLOW CELLS | REVENUE / | PRESENT VALUE @ | | | FV COSTS / | PRESENT VALUE @ | | | |
| TIME | FV INCOME | 4.00% | 10.00% | 13.00% | EXPENSES | 4.00% | 10.00% | 13.00% | FV Cash |
| PERIOD | Mill Pesos | Mill Pesos | Mill Pesos | Mill Pesos | Mill Pesos | Mill Pesos | Mill Pesos | Mill Pesos | Flow |
| TOTAL | 68 | 47.65 | 28.99 | 22.95 | 34 | 29.79 | 24.88 | 22.91 | 34 |
| 0 | | 0.00 | 0.00 | 0.00 | 2 | 2.00 | 2.00 | 2.00 | -2 |
| 1 | | 0.00 | 0.00 | 0.00 | 3 | 2.88 | 2.73 | 2.65 | -3 |
| 2 | | 0.00 | 0.00 | 0.00 | 6 | 5.55 | 4.96 | 4.70 | -6 |
| 3 | | 0.00 | 0.00 | 0.00 | 7 | 6.22 | 5.26 | 4.85 | -7 |
| 4 | | 0.00 | 0.00 | 0.00 | 7 | 5.98 | 4.78 | 4.29 | -7 |
| 5 | 3 | 2.47 | 1.86 | 1.63 | 4 | 3.29 | 2.48 | 2.17 | -1 |
| 6 | 6 | 4.74 | 3.39 | 2.88 | 3 | 2.37 | 1.69 | 1.44 | 3 |
| 7 | 7 | 5.32 | 3.59 | 2.98 | 1 | 0.76 | 0.51 | 0.43 | 6 |
| 8 | 9 | 6.58 | 4.20 | 3.39 | 1 | 0.73 | 0.47 | 0.38 | 8 |
| 9 | 11 | 7.73 | 4.67 | 3.66 | | 0.00 | 0.00 | 0.00 | 11 |
| 10 | 11 | 7.43 | 4.24 | 3.24 | | 0.00 | 0.00 | 0.00 | 11 |
| 11 | 11 | 7.15 | 3.86 | 2.87 | | 0.00 | 0.00 | 0.00 | 11 |
| 12 | 10 | 6.25 | 3.19 | 2.31 | | 0.00 | 0.00 | 0.00 | 10 |

[NOTE: In the actual template, you can make 'trial & error' Assumptions (in the yellow cells) with the variables for up to 30 years, until you get an appropriate acceptable 'Fit.']

## In Conclusion

Because the direct Costs and Benefits of such Projects are all monetary values of tangible items, given quantitative estimates and Hurdle rate criteria, **Benefit/Cost** analysis is a clear-cut 'number crunching' process. Furthermore, facilitated by my templates, the complex amalgam and tiresome computations can be easily estimated by relevant stakeholders and assimilated; then readily reduced, simulated with numerous iterations in planning meetings, and displayed to rapidly reveal "**OK**" or "**NO GO**" decision alternatives.

**Five Key Factors to bear in mind during Trial & Error (T&E) Simulation Planning:**

1. **FUTURE VALUES & RATES for Costs and Revenues are only 'Ceiling Estimates'** – i.e. Best Guesses; and may be increased or decreased. [Consult with technical specialists for realistic estimates.]

2. **Deferring payments of costs to later years, and advancing revenues to earlier years can improve the Benefit/Cost ratio significantly.** [Consult with financial managers, accountants, auditors and economists.]

3. **With periodic O&M, the Operational Life of a project can often be extended**; sometimes even increasing revenues from inflation -- albeit diminishing returns, as O&M costs increase, and the project innovation becomes obsolescent & less efficient. [Consult with Tech Specialists & Managers.]

4. Although you can easily input *'**what if**'* data and criteria to obtain combinations of rates and results that seem DESIRABLE, **YOU HAVE NO CONTROL OVER THE SIZE OF THE DISCOUNT RATE!** [Consult with financial managers and economists.]

5. **Remember: the project planner / manager's role is to facilitate the analytical process**; not to be the expert in all its aspects. **Technicians, Specialists & Economists RULE!**

**Final REMINDER:** Although **Benefit/Cost Analysis** is conducted in terms of ***Present Value Comparisons,*** **after Analysis, the Cost Baseline for Multi-year Project Scheduling must be Budgeted – *preferably by Milestones using the Earned Value Methodology*[3] – using the Present Value for the Base year, plus the Future Values for all subsequent years as Planned Values*.*** Otherwise, all your effort will be for naught! ***[Failure to do this is a common error.]***

Now -- ***like my seminar participants*** -- you know (at least theoretically) **what Benefit/Cost Analysis** is all about, and **how** to do it the '**Easy Way**,' or the '**Hard Way**.' In actual practice, working with multiple contentious stakeholders on-the-job the 'Easy Way' is not so easy; but the 'Hard Way' is bloody hard! The choice it up to you.

**The above templates** -- *plus more than a hundred others related to facilitating different aspects of program & project planning monitoring and evaluation* – **are available for free** upon proof of purchase of my book **Project Management PRAXIS**; available from Amazon.

[3] See my book **Project Management PRAXIS,** as well as my other articles in the **PM World Library** for a detailed understanding of -- and how to apply – the **Earned Value Methodology (EVM)**.

## About the Author

### Dr. Kenneth Smith

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Initially a US Civil Service Management Intern, then a management analyst & systems specialist with the US Defense Department, Ken subsequently had a career as a senior foreign service officer -- management & evaluation specialist, project manager, and in-house facilitator/trainer -- with the US Agency for International Development (USAID). Ken assisted host country governments in many countries to plan, monitor and evaluate projects in various technical sectors; working 'hands-on' with their officers as well as other USAID personnel, contractors and NGOs. Intermittently, he was also a team leader &/or team member to conduct project, program & and country-level portfolio analyses and evaluations.

Concurrently, Ken had an active dual career as Air Force ready-reservist in Asia (Japan, Korea, Vietnam, Thailand, Indonesia, Philippines) as well as the Washington D.C. area; was Chairman of a Congressional Services Academy Advisory Board (SAAB); and had additional duties as an Air Force Academy Liaison Officer. He retired as a 'bird' colonel. After retirement from USAID, Ken was a project management consultant for ADB, the World Bank, UNDP and USAID.

He earned his DPA (Doctor of Public Administration) from the George Mason University (GMU) in Virginia, his MS from Massachusetts Institute of Technology (MIT Systems Analysis Fellow, Center for Advanced Engineering Study), and BA & MA degrees in Government & International Relations from the University of Connecticut (UCONN). A long-time member of the Project Management Institute (PMI) and IPMA-USA, Ken is a Certified Project Management Professional (PMP®) and a member of the PMI®-Honolulu and Philippines Chapters.

Ken's book -- **Project Management PRAXIS** (available from Amazon) -- includes many innovative project management tools & techniques; and describes a "**Toolkit**" of related templates available directly from him at kenfsmith@aol.com on proof of purchase of PRAXIS.

*To view other works by Ken Smith, visit his author showcase in the PM World Library at https://pmworldlibrary.net/authors/dr-kenneth-smith/*