

Overview: Cost Benefit Analysis (CBA)

Introduction

Decision makers must make the most of scarce resources and at the same time respond to ever increasing demands for improved performance and new technology. The importance of investment management in information technology continues to increase. The failure rate of many IT investments raises legitimate concerns about the value of those investments. As a result, IT investment proposals often require a rigorous business case to justify new IT investments. The business case, and associated feasibility studies, will include methods of assessing the costs and returns expected from the investment. These methods include the Cost/benefit Analysis (CBA), which is the primary subject of this document.

Generally, feasibility studies help to determine if potential solutions are viable and provide a basis of comparison and selection between alternatives. Technical feasibility studies focus on the technology of the solution and are used to determine a preferred IT solution from a technology perspective. An economic feasibility study, such as a Cost/ Benefit Analysis (CBA), determines if a solution is economically sound and cost effective. Based upon these analyses, a technology solution is proposed in the next step of the initiation process, and the results of the technical and economic feasibility studies are used to justify the proposed technology solution.

Cost/Benefit Analysis is a systematic approach to estimating the strengths and weaknesses of technology alternatives that satisfy agency business requirements. This guideline will help individuals prepare cost/benefit comparisons with recommendations on how to gather information, present costs, determine benefits, identify risks, and draw economically sound conclusions.

Successful IT Investment Management decision-making begins with the identification of benefits and costs. These two factors are essential items regardless of the nature of the investment, metrics applied, or approach used to value them. Investments in the public sector are undertaken for:

- Expansion or improvement in service or function of agency.
- Reduction of operating costs/increasing revenues.
- Research and development.
- Mandate

Benefits should clearly answer the question, “What does this investment provide the customer, public, or agency?” Whether expressed in qualitative or quantitative terms, benefits should relate directly to the fulfillment of specific, expressed needs.

Estimate and Document Project Cost

Estimated costs are the potential resources consumed by the technology being considered. The cost categories include Internal Staff Labor, Services, Software Tools, Hardware, Supplies and Materials, Facilities, Telecommunications, Training, IV & V and Contingency (Risk). If the technology warrants, the cost categories can be further subdivided.

Historical contract data for an agency can be used to estimate the future purchase price of hardware, software, and services. If contracts were used to provide system support in the past, they can give you the costs for leasing and purchasing hardware and hourly rates for contractor personnel. Contracts for system support services for other systems in your agency can provide comparable cost data for the development and operation of a new system. Adjust the cost to reflect current year price levels. Document all adjustments for future reference.

Benefits

Every proposed IT project for an agency should have identifiable benefits for both the agency and its customers. Identifying these benefits will usually require an understanding of the business processes of the agency and its customers. Some benefits realized by the agency are flexibility, organizational strategy, risk management and control, organizational changes, and staffing impacts. For example, new IT projects may allow some personnel to perform two different jobs with little or no extra training; or the new system may allow organizational changes that reduce the number of managers, or the new system may allow some jobs to be eliminated. These benefits are often measured in terms of productivity gains, staffing reductions, and improved agency effectiveness. Possible benefits to customers include improvements to the current IT services and the addition of new services. These benefits can be measured in terms of productivity gains and cost savings, but the customers must be the ones to identify and determine how to measure and evaluate the benefits. Customer surveys are often needed to identify these benefits. At a minimum, the customers should be interviewed to identify the potential impacts of new or modified systems. Consider the potential impact of a new or modified system in terms of:

- **Accuracy** -The degree of conformity of a measured or calculated value to its actual or specified value.
- **Availability** -The degree to which a system, subsystem, or equipment is operable and in a committable state at the start of a mission
- **Compatibility** - Capability of two or more items or components of equipment or material to exist or function in the same system or environment without mutual interference.
- **Efficiency** - measure of speed and cost.
- **Maintainability** - the ease with which a software system or component can be modified to correct faults, improve performance, or other attributes, or adapt to a changed environment.
- **Modularity** - the extent to which a system is made up of pieces independent in their own right, which makes for the easy assembly of simple autonomous parts into complex structures, is a hallmark of new software; software that's built for networking.
- **Reliability** - The probability that a functional unit will perform its required function for a specified interval under stated conditions.
- **Security** - A condition that results from the establishment and maintenance of protective measures that ensure a state of inviolability from hostile acts or influences.

Questionnaire for Benefit Data Collection

The audience for these questions should be the project sponsor, manager and other stakeholders.

1. What are the agency's/function's/group's major goals and strategies?
2. How will your agency change over the next five years?
3. Who are your customers/constituents? What do you provide to your Customers/constituents?
4. What is your "service"? How do your activities fit in with delivering that service?
5. What is success to you and to your stakeholders? How is that success measured?
6. What are the step-by-step activities that occur in your group to get your "service" to your "customer"?
7. How does your group interact with other groups? Who are you dependent on and who is dependent on you for success?
8. How many people are involved in your group? How many projects, activities? What is the average project time?
9. What are your average costs of labor and other factors?
10. Where do you see the most problems in accomplishing your job (in your group department, agency)?
11. What are the major problem areas you plan to address this year? How do you rank them in importance?
12. How does this problem hurt your group, department, agency, etc.? Are you losing time, money, quality, etc.? How much? What is the impact to your group and your agency?

Determine Tangible Benefits

Tangible benefits originate from increased revenue, cost reduction, and cost avoidance. They measure, in dollar savings, the impact of an alternative on people, equipment, time, space and facilities, and support materials.

Questionnaire for Benefits Verification

The audience for these questions should be the project sponsor, manager and other stakeholders.

1. What benefits do you expect to see from these proposed changes? Can you see [specific benefit] occurring?
2. How much improvement do you expect in time, quality, cost reduction for labor, materials, etc., cost avoidance for labor, etc., revenue?
3. Will all the benefits occur in your area [direct benefits] or will some occur in other areas [indirect benefits]?
4. Do you agree that this proposal can help you address your problems?
5. Do the benefits look right to you and do you believe that this solution will generate benefits in the estimate ranges?

6. Here are some additional benefits that we have uncovered. Do you think you could see any of these occurring with this investment?
7. Are there any potential benefits missing from the list?
8. Are there any additional expenditures that you may need to make if you implement this solution that I am proposing?
9. How would you use any time benefits achieved by this investment? To lower labor costs, increase revenues or a mixture of the two?
10. I have made a summary sheet of the expected amount of benefits that we agreed could result from this investment, could you please help me estimate the dollar value for each of these?
11. What percentage of each of the benefits we discussed earlier do you feel could be attributed to the proposal?
12. Do these benefit estimates look okay? If not, how would you change them?
13. What is high, low, most likely levels of benefits you would expect to see from implementing this proposal?
14. Do you feel that you have all the information you need and that your managers need to understand the value of this proposal to your business?
15. Do you understand the strategic impact of this investment; how it will change the way you do business, and how to manage it to achieve your desired goals and benefits?
16. How can we prove the value of this investment to your senior managers?

Highlights from CBA class presentation:

CBA: Required

COV ITRM Project Management Standard CPM 112-03.6:

- Cost Benefit Analysis required for Category 1, 2, 3 projects.
- Category 4 project:
 - “While a detailed Cost Benefit Analysis is not required for Category Four projects, the Business Case and Alternatives Analysis should, as a minimum, list the potential tangible and intangible benefits that are expected to accrue from completion of the project and the expected Return on Investment (ROI).”

CBA.xlsx

- CBA.xlsx replaces the CBA form in the Commonwealth Technology Portfolio (CTP)
- Complete the CBA.xlsx (Save As... your own version); upload to CTP when complete
- Analyze at least three scenarios:
 - “Do Nothing”
 - Alternative (Alt.) 1
 - Alternative (Alt.) 2
 - Alternative (Alt.) 3 is there if you need it.
- Period of analysis: Six years from project implementation

- Use Fiscal Years (July 1 – June 30)

Ideally...

- Benefits will outweigh costs. But...
 - Mandates may override purely financial analysis
 - Maybe no alternative has net benefits; it may be a comparison of which alternative costs less.
 - Still, CBA will help identify the best financial alternative

CBA is “silent” on...

- Non-monetary measures
- Customer satisfaction
- Probabilities of success
- Political considerations
- Based upon these analyses, a solution is proposed in the next step of the process

CBA Step #1: Determine Costs

- Project costs
 - 12 budget categories in CTP (and CBA.xlsx)
 - Project (implementation) costs
 - Remember to include people costs
 - Use real estimates
- Operation & Maintenance (O&M) Costs:
 - (Additional) Staffing Costs
 - Three staffing categories in CTP (and CBA.xlsx)
 - Other Operational Costs
 - Nine budget categories in CTP (and CBA.xlsx)
 - Use real estimates; NOT +/- compared to today
 - Six years from project implementation

Estimating Costs: Input ideas

- Scope statement
- WBS
- Schedule
- Risks register
- Market conditions
- Your organization’s cost estimating policies
- Cost estimating templates

- Historical information
- Lessons learned
- Your own experiences and judgments

Estimating Costs: Tools, Techniques

- Expert judgement
- Analogous estimating
 - Uses actual costs of previous projects along with expert judgement
- Parametric
 - Uses formulas to determine costs
- Bottom up
 - Estimating individual components of work then adding up
- Three point estimating
 - Most likely, Optimistic, Pessimistic
- Some project management software tools have templates for determining project costs

Total Cost of Ownership (TCO) is the price of implementing a project plus the costs of operation & maintenance over a given time period. When choosing among alternatives, decision-makers should look not just at an investment's short-term cost, but also at its long-term cost, which is the total cost of ownership.

Implementation Cost + O&M (for a given time period) = TCO

CBA Step #2: Calculate Benefits

- Tangible:
 - Cost Savings
 - Cost Avoidance
 - Increased Revenue
 - What about Federal Grants?
- Intangible:
 - Improved quality of life
 - Increase in public safety or accessibility
 - Increased capacity / risk reduction
 - Better data management
 - More secure data - ?
- Cost Savings
 - Increased efficiency / throughput
 - Higher quality = increased effectiveness
 - CBA.xlsx: "Benefit 1. (Note 1.)" = calculated field. O&M savings compared to "Do Nothing" alternative ("Do Nothing" row 38 - row 38)

- Cost Avoidance
 - Avoid hiring staff
 - Avoid technical costs
 - Avoid penalty costs
 - CBA.xlsx: “Benefit 2. (Note 2.)” = Cost Avoidance: If we select this alternative, we will NOT have to purchase _____ in the "Do Nothing" scenario.

- Increased Revenue
 - This only applies to a few agencies...
 - CBA.xlsx: “Benefit 3. (Note 3.)” = Increased Revenues: If we select this alternative, our organization will collect additional revenues.

- What about Federal Grants?
 - Considered a reduction to costs (rather than a benefit)
 - Not many agencies will use this feature
 - CBA.xlsx hide/unhide pink rows to reveal Virginia-specific costs

Brainstorming Project Benefits

- If you know the product, does another state use it? If so, research to see if they have done a CBA for that product.
- If you know the product, look at the vendor marketing material; it can give you ideas on how it can benefit your organization.
- Look at other projects in CTP for ideas; talk to PMD Consultant for ideas.
- Interview stakeholders, users, customers

CBA Step #3: Compare Alternatives

CBA.xlsx automatically calculates (cumulative and total):

- Project costs
- Operations & Maintenance costs
- TCO
- Benefits:
 - Cost Savings
 - Cost Avoidance
 - Increased Revenues
- ROI
- Pretty graphs
- YOU have to calculate Breakeven point – but it is easy.

Return on Investment (ROI)

- ROI: The difference between the cost of a project and the financial benefits that the completed project provides
- (PM Standard = over a six year period)
- Project Benefits – Project Cost = ROI
- ROI often expressed as a percentage:
 - $((\text{Total Benefits} - \text{Total Cost}) / \text{Total Cost}) \times 100\% = \%ROI$
- CBA.xlsx calculates ROI automatically

Breakeven Point

- Breakeven Point: The year when the ROI changes from negative to positive.
- Represents when the IT investment “pays for itself”
- Sooner = better
- On *CBA.xlsx* examine the ROI over the six years of analysis; observe when the ROI becomes positive
- ROI might not become positive in six years

CTP Project Charter: Changes

“Resources & CBA” Tab:

- Project Resources table: Copy & paste Budget figures directly from CBA.xlsx
- O&M Resources table: Copy & paste O&M figures directly from CBA.xlsx
- CBA Summary:
 - Delete the CBA table
 - Add two text boxes:
 - Cost Benefit Analysis Summary: Copy & paste from the “Cost Benefit Analysis Summary” text block for the chosen solution in the BCAA form.
 - Return on Investment (ROI) Summary: Summarize the results of the ROI Analysis for the chosen solution. Copy & paste from the “Return on Investment (ROI) Summary” text block for the chosen solution in the BCAA form.

Instruction sheet for CBA.xlsx Version 4.0

Conventions used in the Cost Benefit Analysis (CBA) Toolkit

1. The CBA Toolkit is an Excel Workbook containing five worksheets:

- a. Summary
- b. Do Nothing
- c. Alternative (Alt) 1.
- d. Alt 2.
- e. Alt 3.

2. Each worksheet contains locked cells and hidden/locked rows. Those cells in XXXXXXXX are unlocked and indicate where data input is required. Cells with XXXXXXXX indicate those cells that are locked and cannot be edited.

3. Data entered into last four worksheets (Do Nothing, Alt 1., Alt 2., Alt 3.) are used for calculations in the first worksheet, Summary.

Instructions for Completing CBA Calculations:

1. Go to the spreadsheet tab Summary:
 - a. Cell A2: Enter the name of the Project
 - b. Cell B4: Enter in the period of analysis
 - i. Note: The Project Management Standard requires six years of O&M analysis once the new product/system is implemented, and it might require 1, 2, 3 years or more to implement the new product/system. Therefore, the six year O&M analysis begins upon implementation.
 - ii. In the example, it took two years to implement the new system, thus the period of analysis is eight years ($2 + 6 = 8$).
 - c. Cell C5: Alt 1. Enter in very brief name of Alternative 1.
 - d. Cell D5: Alt 2. Enter in very brief name of Alternative 2.
 - e. Cell E5: Alt 3. Enter in very brief name of Alternative 3, if needed.
 - f. There are no other cells on this tab which require input. The values presented are calculated in the last four worksheets and are re-presented here and cannot be edited in the Summary tab.
 - g. Note that you can **Unhide** rows 7-19 and 22-28 if you wish. These also are values simply re-presented from the last four worksheets and cannot be edited in the Summary tab.

2. Go to the spreadsheet tab Do Nothing:
 - a. This tab represents (a) the current cost of owning and operating the current, legacy system, and (b) the estimated cost of continuing to use the current, legacy system for the period of time it takes to implement Alternative 1, 2 or 3, plus six years.
 - b. Cell C2: Enter in the first year (fiscal year (FY)) of analysis; the subsequent years will automatically populate, and all three Alternative tabs automatically populate, too.

Costs:
 - c. Rows 3-16: Project Costs: There are NO project costs in the "Do Nothing" scenario.

- d. Rows 20-39: O&M Costs: As follows:
- e. Row 20: Adjust (using Copy & Paste) implementation year(s) and six years of O&M. Make sure all three Alternatives match the Do Nothing tab to ensure equivalent comparison.
- f. Rows 21-26: Staff Costs: Enter the number of (a) FTE IT staff, (b) FTE operations staff, and (c) Operations Contractors, and the annual cost for each.
- g. Rows 29-37: Enter in the O&M Costs.
- h. Note that the annual, (row 38) cumulative (row 39) and total (column M) O&M costs are calculated.
- i. Note that the annual, (row 38) cumulative (row 39) and total (column M) Total Cost of Ownership (TCO) (project + O&M costs) are calculated.

Benefits:

- j. Row 47: Move the six years of analysis (using Copy & Past) left or right to match the Do Nothing Tab. Make sure all three Alternatives match the Do Nothing tab to ensure equivalent comparison.
 - k. Benefit 1.: <calculated field> : Cost Savings: O&M savings compared to "Do Nothing" alternative ("Do Nothing" row 38 - row 38)
 - i. Note: For the "Do Nothing" scenario, there is no O&M savings to report, thus this value should be zero.
 - l. Benefit 2.: Cost Avoidance: If we select this alternative, we will AVOID certain costs associated with the "Do Nothing" scenario.
 - i. Note: For the "Do Nothing" scenario, this value should be zero.
 - m. Benefit 3.: Increased Revenues: If we select this alternative, our organization will collect additional revenues, compared to "Do Nothing".
 - i. Note: For the "Do Nothing" scenario, there likely is no additional revenues savings to report, thus this value should be zero.
 - n. Benefit 4.: Other cost savings, cost avoidance or increased revenues. Explain the savings and the calculations.
 - o. Benefit 5.: Other cost savings, cost avoidance or increased revenues. Explain the savings and the calculations.
 - p. Note the cumulative Return on Investment (ROI) is calculated. $ROI = (\text{ben} - \text{cost}) / \text{cost}$
 - q. Note that the breakeven year can be determined where the ROI changes from a negative % to a positive %.
3. For Alternatives 1, 2 and 3 (tab Alt 1., Alt 2., Alt 3.):
- a. Each Alt tab represents an alternative solution to the business problem presented in the BCAA.
 - b. Cell C2: Enter in the first year (fiscal year (FY)) of analysis; this should match the "Do Nothing" first year. Subsequent years will automatically populate.
- Costs:**
- c. Rows 3-16: Project Costs: Enter costs to implement the project.
 - i. These figures are estimates; additional justification/explanation can be entered into BCAA.
 - ii. Note: These figures can be copied and pasted directly into CTP project budget forms
 - d. Rows 20-39: O&M Costs: As follows:
 - e. Row 20: Make sure all three Alternatives match the Do Nothing tab to ensure equivalent comparison.
 - f. Rows 21-26: Staff Costs: Enter the number of (a) FTE IT staff, (b) FTE operations staff, and (c) Operations Contractors, and the annual cost for each.

- i. These figures represent additional staff, above current staffing level.
 - ii. If the solution results in fewer staff, those savings should be listed in Benefit 4 or 5 and explained.
 - iii. These are estimates; additional justification/explanation can be entered into BCAA.
- g. Rows 29-37: Enter in the O&M Costs.
 - i. These are full-cost estimates; (not the difference compared with today) additional justification/explanation can be entered into BCAA.
- h. Note that the annual, (row 38) cumulative (row 39) and total (column M) O&M costs are calculated.
- i. Note that the annual, (row 38) cumulative (row 39) and total (column M) Total Cost of Ownership (TCO) (project + O&M costs) are calculated.

Benefits:

- j. Row 47: Move the six years of analysis (using Copy & Past) left or right to match the Do Nothing Tab. Make sure all three Alternatives match the Do Nothing tab to ensure equivalent comparison.
- k. Benefit 1.: <calculated field> : Cost Savings: O&M savings compared to "Do Nothing" alternative ("Do Nothing" row 38 - row 38)
 - i. Note: A positive value indicates a cost savings; a negative value indicates comparatively increased costs.
- l. Benefit 2.: Cost Avoidance: Cost Avoidance: If we select this alternative, we will NOT have to purchase _____ in the "Do Nothing" scenario.
- m. Benefit 3.: Increased Revenues: If we select this alternative, our organization will collect additional revenues, compared to "Do Nothing".
- n. Benefit 4.: Other cost savings, cost avoidance or increased revenues. Explain the savings and the calculations.
- o. Benefit 5.: Other cost savings, cost avoidance or increased revenues. Explain the savings and the calculations.
- p. Note the cumulative Return on Investment (ROI) is calculated. $ROI = (\text{ben} - \text{cost}) / \text{cost}$
- q. Note that the breakeven year can be determined where the ROI changes from a negative % to a positive %.

Note: Hidden Rows:

- Summary tab: Rows 7-19: Itemized O&M Cost breakdown
- Summary tab: Rows 22-28: Partial breakdown of Subsidies and Benefits.
- Tabs Do Nothing, Alt 1., Alt 2., Alt 3. Rows 17-19: Detail on Federal Subsidies and cost to Virginia.
- Tabs Do Nothing, Alt 1., Alt 2., Alt 3. Rows 41-44: Detail on Federal Subsidies and cost to Virginia.

Note: When pasting from CBA.xlsx into CTP, CTP does not handle (\$ -) very well. Instead of keying in zero into the CBA cell, just leave it blank. That should allow you to copy from CBA into CTP without a problem.