

## ***Economic Justification: Measuring Return on Investment (ROI) and Cost Benefit Analysis (CBA)***

### **Introduction**

Your business plan must have some type of economic justification to provide your executives and elected officials with financial information. It will help them know that they are doing the “right thing” by implementing the requested program. A popular economic calculation for the attractiveness of an investment is “Return on Investment” (ROI). ROI is a calculation of the most tangible financial gains or benefits that can be expected from a project versus the costs for implementing the suggested program or solution. Cost Benefit Analysis (CBA) is more comprehensive than ROI, and attempts to quantify both tangible and intangible (or “soft”) costs and benefits. The purpose of this guide is to make these measurement techniques a little more understandable.

### **Calculating ROI**

ROI is represented as a ratio of the expected financial gains (benefits) of a project divided by its total costs. As a formula it appears as:

#### **ROI = (net benefits/total cost)**

In the equation above, net benefits equals total benefits minus total cost. It is the incremental financial gain (or loss).

If a parcel mapping project costs \$50,000 to implement, and you demonstrate \$25,000 in net benefits,

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then the ROI calculation would appear as follows.

$$\text{ROI} = (25,000/50,000)$$

The ROI in this example is 50% which represents a positive return on the investment. It takes an ROI ratio greater than zero for a program to be attractive, typically. A sub-zero ratio may not automatically “kill” a project, because it may result in a required capability that doesn’t currently exist. Not all government functions are required to have a positive rate of return as they are in the business world. Government is required to provide certain services to the public, and so is more tolerant of low ROI.

Comparing the ROI of various options will help to ensure that you select the most cost effective technology and approach. You can provide additional support for negative (and positive) rates of return with the qualitative benefits identified by your planning team. Later in this guide, a discount factor will be applied, to show the Net Present Value (NPV) of future costs and benefits, which is an important consideration when comparing alternatives.

**NOTE:** Even a project with an outstanding ROI may be controversial or doomed to failure if the investment cost is very high.

### **Performing CBA**

These calculations are more comprehensive than ROI, in that they attempt to quantify both tangible and intangible costs and benefits. Historically, CBA has been applied to large public works projects with societal cost and benefits that are more difficult to quantify than “hard” technology costs.

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Intangible benefits and costs are very relevant to an overall determination of what is a good investment for the public well-being. SSDI implementation includes both types, and is therefore a candidate for applying CBA, if the expertise and resources are available to support the effort. There are a number of economic methodologies for monetizing benefits and costs that do not have easily discovered market prices, but these can be complex and any estimate derived from them may have relatively high uncertainty.

Like an ROI calculation, the result of CBA is a ratio expressed as a percentage, and economic attractiveness is determined the same way: above zero is attractive, and below zero is not. The equation is the same, although more costs and benefits are included. That is the essential difference between the two methods.

## Effect of Time on ROI and CBA Calculations

In most cases, executives and elected officials expect to see an economic justification based on phased benefits and costs over a three to five year window. Being able to show a positive ROI in a one or two year timeframe will probably make your project an instant hit, but this is an unusual circumstance.

Given the time value of money, a dollar is worth more today than it will be tomorrow. To account for this economic fact, future costs and benefits need to be “discounted” in order to calculate today’s value (a.k.a., Net Present Value, or NPV). The discount factor, also known as the cost of capital, might be specified by various state authorities, and usually reflects the interest rate the

state pays to borrow money when it issues general obligation bonds. By comparison, the federal Office of Management and Budget (OMB) recommends the following nominal discount rates for federal programs, depending on the length of the program.

Duration	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Discount Rate	2.7%	3.3%	3.7%	4.2%

Source: OMB Circular A-94 Appendix C, as of 12/12/08

In the parcel mapping calculation of ROI, to apply a discount factor to determine the Net Present Value (NPV) of a future stream of benefits and costs, the following equation and factors would be used:

B = Benefits; C = Costs; r = discount rate; t = time period; n = number of time periods.

NPV equals the summation from t = 0 (the initial start-up of the program) to t = n (the final year of the program) of  $[(B_t - C_t) / (1 + r)^t]$ .

For a 3 year program, the equation would be as follows:

$$NPV = [(B_0 - C_0)] + [(B_1 - C_1) / (1 + r)] + [(B_2 - C_2) / (1 + r)^2] + [(B_3 - C_3) / (1 + r)^3]$$

In the table on the parcel mapping example, the above equation was applied, and the resulting NPV calculated out to be \$22,120.

The longer the project duration, the greater the risks due to changes in work process flow and other external factors that may lead to a new project design and additional costs.

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	<b>Initial Costs</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Cumulative Total</b>
<b>Total Costs</b>	\$35,000	\$5,000	\$5,000	\$5,000	\$50,000
<b>Total Benefits</b>	\$0	\$25,000	\$25,000	\$25,000	\$75,000
<b>Net Benefit</b>	-\$35,000	\$20,000	\$20,000	\$20,000	\$25,000
<b>Net Present Value</b>					
<b>Initial Year</b>	-\$35,000				
<b>Year 1</b>	\$19,512				
<b>Year 2</b>	\$19,036				
<b>Year 3</b>	\$18,572				
<b>NPV =</b>	<b>\$22,120</b>				
<b>Discount Factor (2.5 %)</b>	0.025				
<b>Initial Period Denominator</b>	1.000				
<b>Year 1</b>	1.025				
<b>Year 2</b>	1.051				
<b>Year 3</b>	1.077				

This table feeds our earlier example calculation of ROI = (\$25,000/\$50,000) where the ROI is calculated to be 50% for the parcel mapping project. By adding a discount factor and calculating NPV (see aforementioned formula), the economic attractiveness diminishes only slightly (\$22K vs. \$25K), but is still positive, and more meaningful because it accounts for the time value of money.

### **Calculating Costs**

Most organizations have effective methods for identifying their costs. Information on personnel costs can be obtained from fiscal officers, there are often contracts in place (or as historical references) for certain services, and managers can turn to their counterparts in other organizations to obtain reasonable cost estimates.

Include the following incremental costs when determining your total cost:

- Labor Including Fringe Benefits
- Overhead (if appropriate)
- Additional Equipment Cost (not including additional costs for existing equipment)
- Additional Software Cost (not including additional costs for existing software)

- Physical Facilities (if additional space is required)
- Contracting Costs

You should also consider the various phases of a project and account for all of the costs incurred during each phase. Many people improperly ignore the “built-in” costs and only account for large contractual expenditures. Examples of built-in costs include:

- Project Management
- Contract Management
- Quality Assurance and Control
- Personnel Training
- Project Maintenance
- Security (if appropriate)

### **Calculating Benefits**

This is the most difficult part of completing an economic justification.

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There are very few guidelines that provide you with average benefit factors for implementing applications, data development, or coordination activities. NASA reported that adherence to open standards and interoperability specifications during project implementation resulted in 119% ROI as a “savings to investment” ratio. (See [http://www.egy.org/files/ROI\\_Study.pdf](http://www.egy.org/files/ROI_Study.pdf))

Items to include in your study include “internal” or “external” costs and benefits to your organization. It is generally much easier to document the internal costs, because you should have a good understanding of the work process flow and where the savings will occur. It can be extremely difficult (or nearly impossible) to identify the “downstream” benefits that are accrued by other users and the general public.

Examples of the internal benefits you should measure include:

- Savings from new capabilities
- Decreased time to perform repetitive tasks
- Decreased travel
- Decreased wait times
- Fewer mistakes
- Increase in billable services
- Increased customer base
- Improved customer satisfaction
- Decreased training costs
- Improved regulatory compliance (i.e. reduction of fines)
- Reduced reporting requirements
- Reduced telecommunications charges
- Reduced dependency on consultants

As already noted, accurately identifying benefits can be very difficult and time consuming. It helps to list all of the expected benefits and then prioritize

them in terms of your “hunches” on the largest expected paybacks. Explain your assumptions and known biases related to your “hunches” when documenting your approach. After that, make your best guess on the ease of obtaining the information required to complete the calculation. Use these lists to set your priorities for working on economic justification.

Examples of external and downstream benefits that you might measure include:

- All of the above benefits that can be quantified in other agencies or levels of government due to the proposed initiative.
- Public and Private Sector benefits that can be clearly defined (i.e. by having assessment data on-line, appraisers can perform assessments in their office and not have to drive to county or state tax offices, thereby saving them time and travel expenses)
- Private sector benefits from being geospatially enabled (i.e. a company specializing in road centerline data gets access to better road geometry and provides more added values for other customers)
- Public benefits from being geospatially enabled (i.e. being able to locate a hotel near a business appointment on a web based mapping system that saves time and travel expenses)

These external and downstream benefits can be very complex to calculate and will probably be beyond the scope of your planning efforts. However, the members of your planning team should think about these benefits; and when they can be readily calculated, include them in your business plan.

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## Putting it in Perspective

ROI and CBA calculations are useful, because they allow you to examine your options and make more informed choices. They are also an essential component of your business plan, because they become the “proof” that implementing a project is a sound business decision. ROI is useful when costs and benefits are tangible and tightly focused on a specific program with boundaries. CBA is more comprehensive, and is useful when both tangible and intangible costs and benefits need to be considered.

Before you begin development of your business plan, you should determine what statutory or other requirements you have for developing ROI or other types of calculations in prescribed formats. Many states have specific guidance and formats identified in their budget or IT plans. In addition, you should determine the threshold for project value at which you must perform these analyses. The level of effort that you put toward ROI/CBA should be commensurate with the contemplated expenditure. For example, spending a week’s worth of your time to gather information and crunch numbers may not be a wise investment of time in order to justify a project expenditure of \$10,000, but it might be if the amount is \$100,000.

As already noted, examples of ROI and CBA calculations for geospatial projects can be very elusive. Please share any information, tools, or new concepts with your peers.

NOTE: This overview of ROI and CBA is a companion piece to the **Strategic and Business Plan Guidelines** produced under contract to the Federal Geographic Data Committee (FGDC) Secretariat, in support of the Fifty States Initiative. The Guidelines and related materials are available on both the FGDC and NSGIC websites.