

APPENDIX F-1 COST BENEFIT ANALYSIS SAMPLE 1

Post Implementation Review Analysis

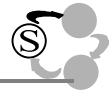
This appendix consists of a sample cost benefit analysis developed as a supplement to the *Cost Benefit Analysis Guide for NIH IT Projects*, originally prepared by Robert Lagas, National Institutes of Health, Department of Health and Human Services date May 1999. The Trail Boss Interagency Committee has designated this guide as a “best practices approach.”

This is not a normal CBA, but it is the kind that may be used as part of an investment review process in an organization.

This analysis is much simpler and easier to do than the CBA that should be done before a system is designed and implemented. This sample was selected because it illustrates the basic concepts of ignoring sunk (past) costs, discounting costs and benefits, comparison of costs and benefits, and the use of Benefit-Cost Ratio and rate of return on investment. Sample 2 (*Appendix F-2*) addresses all of those concepts plus a comparison of cost alternatives at the beginning of the project. This sample is based on Sample 2, and assumes that a CBA was done at the beginning of the project, and the cost and benefit estimates from that report could have been updated to do this CBA.

Table of Contents

EXECUTIVE SUMMARY	180
1 INTRODUCTION	181
1.1 PURPOSE	181
1.2 AHR INVESTMENT REVIEW PROCESS	181
1.3 HRMES BACKGROUND	182
2 ANALYSIS OVERVIEW	182
3 COSTS	182
3.1 OPERATIONAL COSTS	182
3.2 MAINTENANCE COSTS	183
3.3 TOTAL COSTS	183
4 BENEFITS	183
5 COMPARISON OF COSTS AND BENEFITS	184
6 CONCLUSIONS	184
7 RECOMMENDATION	185



APPENDIX F-1 (COST BENEFIT ANALYSIS SAMPLE 1 CONTINUED)

EXECUTIVE SUMMARY

This Cost-Benefit analysis was performed to satisfy a requirement of the AHR Information Technology Investment Review Process. The process requires that a Post-Implementation Review (PIR) be conducted for each new IT system within 18 months after the system becomes operational. The HRMES became operational 14 months ago, and this analysis is a key component of the PIR. It addresses the latest projections of the costs and benefits of the system to determine if the system should continue to operate as currently implemented. It will also be used to determine how accurate the previous estimates were for the costs and benefits of the system.

One of the basis concepts of Cost-Benefit analysis is not to consider sunk costs (money already spent). This appears to be consistent with the one of the purposes of the PIR, which is to determine whether or not to proceed with the project according to the current plan. Because this analysis is being done after the development costs have been incurred, the purpose of this Cost-Benefit analysis is not to determine if the projected development and operational costs of the system will be justified by the projected benefits, but rather to evaluate whether the projected costs and benefits (starting with Fiscal Year 2000) justify continuation of the project.

The comparison of the benefits relative to the costs of continuing the system indicates that the project should continue. The table below demonstrates that the benefits exceed the costs of operating and maintaining the system through the remainder of its life cycle. The Benefit/Cost Ratio of 1.06 for the seven-year period basically means that we are getting \$1.06 in benefits for every dollar spent during that time period. That is a 6% return on investment (ROI).

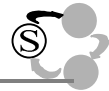
Description / FY	2000	2001	2002	2003	2004	2005	2006	Total
Annual Costs	310,000	310,000	310,000	310,000	310,000	310,000	310,000	2,170,000
Annual Benefits	328,155	328,155	328,155	328,155	328,155	328,155	328,155	2,297,083
Discount Factor	0.9825	0.9483	0.9154	0.8836	0.8529	0.8232	0.7946	
Discounted Costs (DC)	304,566	293,983	283,767	273,907	264,389	255,201	246,333	1,922,147
Disc. Benefits (DB)	322,403	311,200	300,386	289,948	279,872	270,147	260,760	2,034,714
Disc. Net (DB-DC)	17,837	17,217	16,618	16,041	15,484	14,946	14,426	112,568
Benefit/Cost Ratio	1.0586	1.0586	1.0586	1.0586	1.0586	1.0586	1.0586	1.0586

The recommendation is that the operation of HRMES should continue; however, the low ROI will place it at risk when it competes with other projects for the limited funds available for centrally funded IT projects.

A comparison of the original estimates to the actual expenditures and current projections for costs and benefits is shown below:

	Development	Annual Operations and Maintenance	Annual Benefits
Original Estimate	\$732,177	\$214,080	\$492,232
Current Estimate or Actuals	\$735,857	\$310,000	\$328,155

The following chart shows an updated comparison of the costs and benefits projected in the original Cost-Benefit Analysis.



APPENDIX F-1 (COST BENEFIT ANALYSIS SAMPLE 1 CONTINUED)

Year	Annual Cost AC	Annual Benefit AB	Discount Factor DF	Discounted Cost (DC) ACxDF	Discounted Benefit (DB) ABxDF	Discounted Net DB-DC	Cumulative Discounted Net
1	268,137		0.9825	263,437	0	(263,437)	(263,437)
2	467,720		0.9483	443,554	0	(443,554)	(706,991)
3	310,000	328,155	0.9154	283,767	300,386	16,618	(690,372)
4	310,000	328,155	0.8836	273,907	289,948	16,041	(674,331)
5	310,000	328,155	0.8529	264,389	279,872	15,484	(658,848)
6	310,000	328,155	0.8232	255,201	270,147	14,946	(643,902)
7	310,000	328,155	0.7946	246,333	260,760	14,426	(629,476)
8	310,000	328,155	0.7670	237,774	251,698	13,925	(615,551)
9	310,000	328,155	0.7404	229,511	242,952	13,441	(602,110)
10	310,000	328,155	0.7146	221,536	234,510	12,974	(589,136)
Total	3,215,857	2,625,238		2,719,409	2,130,272	(589,136)	

This shows that the cost of development will not be recovered during the life of the system. The Discounted Costs exceed the Discounted Benefits by nearly \$600,000 over the life cycle of the system. This gives us a negative return on investment. If the numbers above were used in the original CBA, the project would have been terminated before the development was initiated.

1 INTRODUCTION

This section explains the purpose of this analysis, includes information about the Department of Health (DOH) Agency for Health Research (AHR) investment review process, and provides background information on the Health Research Management Evaluation System (HRMES).

1.1 PURPOSE

This Cost-Benefit analysis was performed to satisfy a requirement of the AHR Information Technology Investment Review Process. The process requires that a Post-Implementation Review (PIR) be conducted for each new IT system within 18 months after the system becomes operational. The HRMES became operational 14 months ago, and this analysis is a key component of the PIR. It addresses the latest projections of the costs and benefits of the system to determine if the system should continue to operate as currently implemented. It will also be used to determine how accurate the previous estimates were for the costs and benefits of the system.

1.2 AHR INVESTMENT REVIEW PROCESS

The AHR Chief Information Officer (CIO) established an AHR IT Investment Review Process as an integral part of compliance with the Clinger-Cohen Act. All centrally funded IT systems are reviewed by an IT Investment Review Board (ITIRB) during various stages of the System Life Cycle. A Conceptual Review is conducted during the planning stage, and the project must receive approval from ITIRB and the AHR CIO before funds are approved for developing the final plans

**APPENDIX F-1 (COST BENEFIT ANALYSIS SAMPLE 1 CONTINUED)**

for design, development and implementation. A Detailed Review is done by the ITIRB after a comprehensive Cost-Benefit Analysis has been completed, and the approval of the ITRB and the CIO must be obtained before funds are approved for the design, development and implementation of the system. Progress reviews will be conducted during the design and development phases on a schedule established during the Detailed Review. A Post-Implementation Review (PIR) will be conducted within 18 months after the system becomes operational. Progress reviews for operational systems will be conducted according a schedule established by the ITIRB during the PIR.

1.3 HRMES BACKGROUND

The Health Research Management Evaluation System (HRMES) provides managers in the Agency for Health Research (AHR) with an administrative information system that generates reports showing the status of the organization and evaluates the effectiveness of the managers. The system not only reports the status of the eight AHR Bureaus in terms of dollars spent, projects completed, and personnel utilization; it also provides a quantitative evaluation of the success in achieving goals and objectives that support the missions of the Bureaus. It automated many of the manual activities required to implement the Government Performance and Results Act of 1993.

2 ANALYSIS OVERVIEW

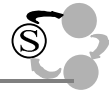
One of the basis concepts of Cost-Benefit analysis is not to consider sunk costs (money already spent). This is consistent with the ITIRB=s purpose, which is to determine whether or not to proceed with the project according to the current plan. Because one of the purposes of a PIR is to determine the accuracy of the original estimates for the project, this analysis will also show the historical costs for design, development and implementation so they can be compared to the estimates in the Cost-Benefit Analysis prepared for the detailed review.

The first step will be to review the projected operational and maintenance costs for the life of the system. The second step will be to examine the projected benefits for the life of the system. The costs and benefits will then be compared to determine if the tangible benefits justify the costs for operation and maintenance of the system. Return on investment will also be computed for comparison with other IT investments. Comparison with the original estimates will also be done as part of this analysis.

3 COSTS

The projected costs are broken down by the categories of operations and maintenance for the last seven years of the system life cycle.

3.1 OPERATIONAL COSTS



APPENDIX F-1 (COST BENEFIT ANALYSIS SAMPLE 1 CONTINUED)

The operational costs for 1999 were \$135,000. The table below shows the breakdown of those costs, and projects the same costs for each of the remaining years of the life cycle.

Description/ FY	2000	2001	2002	2003	2004	2005	2006	Total
Contractor Support	90,000	90,000	90,000	90,000	90,000	90,000	90,000	630,000
Internal Labor	30,000	30,000	30,000	30,000	30,000	30,000	30,000	210,000
HW/SW/Supplies	15,000	15,000	15,000	15,000	15,000	15,000	15,000	105,000
Total	135,000	135,000	135,000	135,000	135,000	135,000	135,000	945,000

3.2 MAINTENANCE COSTS

The maintenance costs for 1999 were \$175,000. The table below shows the breakdown of those costs and projects the same costs for each of the remaining years of the life cycle.

Description/ FY	2000	2001	2002	2003	2004	2005	2006	Total
Contractor Support	100,000	100,000	100,000	100,000	100,000	100,000	100,000	700,000
Internal Labor	35,000	35,000	35,000	35,000	35,000	35,000	35,000	245,000
HW/SW/Supplies	40,000	40,000	40,000	40,000	40,000	40,000	40,000	280,000
Total	175,000	175,000	175,000	175,000	175,000	175,000	175,000	1,225,000

3.3 TOTAL COSTS

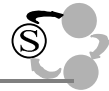
The table below illustrates the total costs for the seven remaining years of system life cycle.

Description/ FY	2000	2001	2002	2003	2004	2005	2006	Total
Operational Costs	135,000	135,000	135,000	135,000	135,000	135,000	135,000	945,000
Maintenance Costs	175,000	175,000	175,000	175,000	175,000	175,000	175,000	1,225,000
Total	310,000	310,000	310,000	310,000	310,000	310,000	310,000	2,170,000

4 BENEFITS

The primary projected benefit of the system was the cost avoidance of the salaries of the staff personnel manually preparing performance reports. The study showed that the average grade of the people in the eight Bureaus was a GS-12. The study also indicated that about 25% of a person's time would still be required to enter performance data and goals and objectives. It was estimated that 75% of the time for each of the people in the Bureaus would be available for other duties, and the annual cost avoidance in each Bureau will be equal to 75% of the annual cost of a GS-12. The Post-Implementation Review showed that the time-savings were only 50%. Using \$82,038.68 as the annual burdened cost for a GS-12, multiplying by .50 gives the annual savings for each person, and multiplying by eight gives the annual cost avoidance as demonstrated below.

Annual Burdened Cost	Cost Avoidance Factor	# of Workers	Annual Cost Avoidance
(C)	(A)	(N)	CxAxN
82,038.68	0.50	8	328,155



APPENDIX F-1 (COST BENEFIT ANALYSIS SAMPLE 1 CONTINUED)

The values of increased accuracy and more timely creation of the reports were also projected benefits. Unfortunately, we still do not have a good way of assigning dollar values to those benefits.

5 COMPARISON OF COSTS AND BENEFITS

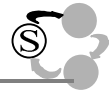
The table below illustrates the total costs and total benefits from FY 2000 through FY 2006. The costs are discounted on the assumption that costs are incurred and benefits accrue throughout each year. The Discounted Costs are computed by multiplying the Annual Costs by the Discount Factor for the year. The Discounted Benefits are computed in the same manner, by multiplying the Annual Benefits by the Discount factor for the year.

Description / FY	2000	2001	2002	2003	2004	2005	2006	Total
Annual Costs	310,000	310,000	310,000	310,000	310,000	310,000	310,000	2,170,000
Annual Benefits	328,155	328,155	328,155	328,155	328,155	328,155	328,155	2,297,083
Discount Factor	0.9825	0.9483	0.9154	0.8836	0.8529	0.8232	0.7946	
Discounted Costs (DC)	304,566	293,983	283,767	273,907	264,389	255,201	246,333	1,922,147
Disc. Benefits (DB)	322,403	311,200	300,386	289,948	279,872	270,147	260,760	2,034,714
Disc. Net (DB-DC)	17,837	17,217	16,618	16,041	15,484	14,946	14,426	112,568
Benefit/Cost Ratio	1.0586	1.0586	1.0586	1.0586	1.0586	1.0586	1.0586	1.0586

The comparison above demonstrates that the benefits barely outweigh the costs of the system from FY2000 through FY 2006. The Benefit/Cost Ratio (BCR), Discounted Benefits divided by Discounted Costs, is 1.0586; which basically means that we are getting \$1.06 in benefits for every dollar spent for the 7-year period. That is a return on investment (ROI) of .0586, which would normally be expressed as 6%. The ROI can also be computed by dividing the Discounted Net by the Discounted Costs ($\$112,568 / \$1,922,147 = .0586$). Multiplying .0586 by 100 and rounding to the nearest percentage, gives us 6% as the ROI. The easier way to determine the ROI is to subtract 1 from the BCR, and then convert the remainder to a percentage.

6 CONCLUSIONS

The analysis shows that the benefits barely exceed the costs of operating the system, and the return on investment is relatively low. If it were not for the concept that Cost-Benefit Analysis should not consider sunk costs (costs already incurred), the conclusion might have been to terminate the system and return to the manual process. That is unlikely, because someone would probably come up with values of the intangible benefits to justify continuation of the system. However; it is appropriate at this point to look at the total system life cycle costs in relation to the benefits. The following chart shows an updated comparison of the costs and benefits projected in the original Cost-Benefit Analysis.

**APPENDIX F-1 (COST BENEFIT ANALYSIS SAMPLE 1 CONTINUED)**

Year	Annual Cost AC	Annual Benefit AB	Discount Factor DF	Discounted Cost (DC) ACxDF	Discounted Benefit (DB) ABxDF	Discounted Net DB-DC	Cumulative Discounted Net
1	268,137		0.9825	263,437	0	(263,437)	(263,437)
2	467,720		0.9483	443,554	0	(443,554)	(706,991)
3	310,000	328,155	0.9154	283,767	300,386	16,618	(690,372)
4	310,000	328,155	0.8836	273,907	289,948	16,041	(674,331)
5	310,000	328,155	0.8529	264,389	279,872	15,484	(658,848)
6	310,000	328,155	0.8232	255,201	270,147	14,946	(643,902)
7	310,000	328,155	0.7946	246,333	260,760	14,426	(629,476)
8	310,000	328,155	0.7670	237,774	251,698	13,925	(615,551)
9	310,000	328,155	0.7404	229,511	242,952	13,441	(602,110)
10	310,000	328,155	0.7146	221,536	234,510	12,974	(589,136)
Total	3,215,857	2,625,238		2,719,409	2,130,272	(589,136)	

In the scenario above, the original estimates for the cost of developing the system were quite accurate. The original estimate for the first year was \$270,137 compared to the actual cost of \$268,137. The original estimate for the second year was \$462,020 compared to \$467,720. The actual costs for operations and maintenance turned out to be \$310,000 instead of the original \$214,080. The single most important factor turned out to be the lower than expected benefits, \$328,155 compared to the original estimate of \$492,232. The result is that the cost of development will not be recovered during the life of the system. The Discounted Costs exceed the Discounted Benefits by nearly \$600,000 over the life cycle of the system. This gives us a negative return on investment. If the numbers above were used in the original CBA, the project would have been terminated before the development was initiated.

7 RECOMMENDATION

The operation of the system should continue; however, given its low ROI (6%), the money may be better spent on some other projects. That decision will be made during the annual review of centrally funded systems.

