



Department of Defense **INSTRUCTION**

NUMBER 7041.03
September 9, 2015

DCAPE

SUBJECT: Economic Analysis for Decision-making

References: See Enclosure 1

1. **PURPOSE.** In accordance with the authority in DoD Directive (DoDD) 5105.84 (Reference (a)), this instruction:

a. Reissues DoD Instruction 7041.3 (Reference (b)) to establish policy, assign responsibilities, and provide procedures for conducting cost-effective economic analyses evaluating the costs and benefits of any government decisions to initiate, renew, or expand program or project alternatives under the Office of Management and Budget (OMB) Circular No. A-94 (Reference (c)).

b. Authorizes the Defense Economic Analysis Council (DEAC) as the means to pursue uniform economic policy throughout DoD, resolve any issues that may arise, and represent joint Military Service opinion to OSD.

2. **APPLICABILITY.** This instruction:

a. Applies to:

(1) OSD, the Military Departments, the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, and the DoD Field Activities, and all other organizational entities within the DoD (referred to collectively in this instruction as the "DoD Components").

(2) The evaluation of decisions about the startup research, acquisition, renewal, renovation, conversion, upgrade, expansion, pre-planned product improvement, leasing, or operations of all programs or projects issued under the authority of this instruction. The adoption of such programs and projects is expected to commit the government to a series of measurable expenditures or benefits beyond the inception date.

(3) Prescribed methodologies to all considerations for investment.

(4) The evaluation of decisions about:

(a) The use of real property or other assets, such as by lease or purchase.

(b) The acquisition of automated information systems.

(c) The acquisition of weapons systems and weapons systems support. Analytic studies and Business Case Analysis (BCA) that deal with cost and effectiveness considerations in those areas are considered to be “economic analyses” (even though not specifically titled as such) and must adhere to the policy in this instruction in accordance with DoDDs 5000.01 and 4275.5 (References (d) and (e)).

b. Does **not** apply to decisions about:

(1) Federal energy management and planning programs. These programs must follow the guidance in Part 436 of Title 10, Code of Federal Regulations (Reference (f)).

(2) Commercial activities, including commercial-type services by government or contractor operation that would not fall under paragraph 2a(4).c above the signature.

(3) The Army Corps of Engineers water resource projects. Guidance for these projects is the approved economic and environmental principles and guidelines for water and related land resources implementation studies.

(4) Programs or projects that involve costs or quantifiable benefits primarily external to the Federal Government. Analyses for those types of programs or projects are addressed as “public investment and regulatory analyses” in accordance with Reference (c).

3. POLICY. It is DoD policy that:

a. The concepts of economic analysis constitute an integral part of the DoD Planning, Programming, Budgeting, and Execution Process as described in DoDD 7045.14 (Reference (g)).

b. DoD Components with budget line items exceeding the investment-expense criteria of DoD 7000.14-R, Volume 2A (Reference (h)) must provide supporting economic analyses to the Under Secretary of Defense (Comptroller)/Chief Financial Officer of the Department of Defense (USD(C)/CFO) in accordance with the procedures in Enclosure 2.

c. A complete economic analysis should adhere to the procedures in Enclosure 2 to support decisions based on life-cycle costs.

d. The method of documentation used to record and summarize cost and benefit information may vary between the DoD Components. When possible, the DoD Components are encouraged to standardize format and documentation requirements to ensure consistent and complete

economic analysis submissions. Automated information tools and data sources are encouraged to reduce paperwork and provide the audit trail.

4. RESPONSIBILITIES

a. Director of Cost, Assessment, and Program Evaluation (DCAPE). In addition to the responsibilities in paragraphs 4b(1)-(2) above the signature, The DCAPE:

(1) Serves as primary point of contact to answer questions and other inquiries about this instruction.

(2) Oversees the Defense Economic Analysis Council in its implementation of the duties outlined in Enclosure 3.

b. OSD and DoD Component Heads, not including the DoD Field Activities. The OSD and DoD Component heads, not including the DoD Field Activities:

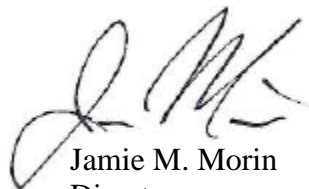
(1) Establish Component guidance to implement the policy and procedures in this instruction.

(2) Present any conflicts to DEAC for resolution.

5. PROCEDURES. See Enclosure 2.

6. RELEASABILITY. **Cleared for public release**. This instruction is available on the Internet from the DoD Issuances Website at <http://www.dtic.mil/whs/directives>.

7. EFFECTIVE DATE. This instruction is effective September 9, 2015.



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Enclosures

1. References
2. Procedures for Economic Analysis
3. The Defense Economic Analysis Council

Glossary

ENCLOSURE 1

REFERENCES

- (a) DoD Directive 5105.84, “Director of Cost Assessment and Program Evaluation (DCAPE),” May 11, 2012
- (b) DoD Instruction 7041.3, “Economic Analysis for Decision Making,” November 7, 1995 (hereby cancelled)
- (c) Office of Management and Budget Circular No. A-94, “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,” October 29, 1992
- (d) DoD Directive 5000.01, “The Defense Acquisition System,” May 12, 2003
- (e) DoD Directive 4275.5, “Acquisition and Management of Industrial Resources,” March 15, 2005
- (f) Part 436 of Title 10, Code of Federal Regulations,
- (g) DoD Directive 7045.14, “The Planning, Programming, Budgeting, and Execution (PPBE) Process,” January 25, 2013
- (h) DoD 7000.14-R, “DoD Financial Management Regulation,” Volume 2A, current edition¹

¹ Available on the internet at <http://comptroller.defense.gov/FMR.aspx>

ENCLOSURE 2

PROCEDURES FOR ECONOMIC ANALYSIS

1. GENERAL PRINCIPLES. A sound economic analysis recognizes that there are alternative ways to meet a given objective and that each alternative requires certain resources and produces certain results. To achieve a systematic evaluation, the economic analysis process uses the following two principles:

- a. Each reasonable alternative for meeting an objective must be considered, and its life-cycle costs and benefits evaluated.
- b. All costs and benefits are adjusted to present value by using discount factors to account for the time value of money. Both the size and the timing of costs and benefits are important.

2. ELEMENTS OF AN ECONOMIC ANALYSIS. A complete economic analysis of investment alternatives includes:

a. Objective. The statement of the objective should clearly define and quantify (to the extent possible) the function to be accomplished. The statement of the objective should not assume a specific means of achieving the desired result. If such an assumption is made, the statement of the objective undermines the analytical purpose of the economic analysis by prejudging the result and should be avoided.

b. Assumptions. Base economic analysis on facts and data whenever possible. Since economic analysis deals with costs and benefits occurring in the future, assumptions must be made to account for the uncertainties.

c. Alternatives. All reasonable ways of satisfying the objective must be documented and discussed. The recommendation resulting from the economic analysis comes from the options evaluated. Careful attention must be given to identifying alternatives.

d. Costs and Benefits. The costs and benefits associated with each alternative under consideration should be quantified whenever possible, so they may be included in the economic analysis calculations. When quantification is not possible, the analyst should still attempt to document significant (qualitative) costs and benefits. Minimally, qualitative costs or benefits should be discussed in narrative format.

e. Comparison of Alternatives. Compare the costs and benefits of each alternative, including a calculation of the Return on Investment (ROI) if the analysis is in support of a Major Automated Information System acquisition, and rank them according to net present value. See Appendix 3 to Enclosure 2 for guidance on calculating net present values.

f. Sensitivity and Uncertainty Analyses. The analyst should account for uncertainties in the analysis by testing the sensitivity of the economic analysis results to various factors in accordance with the guidance in Appendix 1 to this enclosure.

g. Results and Recommendations. The economic analysis report should begin with a summary of the analysis (based on the benefits and costs of the alternatives) and an interpretation of the results (to include a recommendation of the preferred alternative). The actual decision is based on qualitative as well as quantitative factors. The results of the economic analysis, including all calculations and sources of data, must be documented down to the most basic inputs to provide an auditable and stand-alone document.

3. IDENTIFICATION OF ALTERNATIVES. The purpose of the economic analysis is to give the decision maker insight into economic factors bearing on accomplishing the objectives. Therefore, it is important to identify factors such as cost and performance risks and drivers that can be used to establish and defend priorities and resource allocations. The discussion of alternatives in the economic analysis determines which options to analyze.

a. Considerations. The analyst must consider and document, minimally:

- (1) Status quo or current functional baseline.
- (2) New acquisition or strategic functional performance objective(s).
- (3) Leasing in accordance with the guidance in Appendix 2 of this enclosure.
- (4) Modification of existing assets to include: renovation, conversion, upgrade, expansion, or other forms of improvement of existing assets or services.

b. Alternatives. Alternatives must be fully investigated and a determination made as to whether the alternative satisfies the functional requirements for the project.

- (1) Alternatives considered possible are compared in the economic analysis.
- (2) Alternatives dismissed as unreasonable must be discussed, but need not be formally compared in the economic analysis.
- (3) Aggressive pursuit of alternatives is strongly encouraged so innovative and improved ways of doing business are actively considered.

4. ANALYTICAL METHODOLOGY AND CRITERIA

a. Parameters. Besides discounting procedures, the treatment of inflation, and economic comparison criteria, an economic analysis of investment alternatives consists of basic parameters necessary to account for how costs and benefits for each alternative are displayed, treated, and

reported. Those basic parameters are economic life – which includes physical life, mission life, and technological life – start year, lead time, period of analysis, and base year.

b. Treatment of Costs and Benefits. For each alternative, an economic analysis needs to identify the pertinent costs and benefits, estimate the magnitude of those costs and benefits, and estimate the timing of the costs and benefits.

(1) Identification of Costs and Benefits. Analyses should include comprehensive estimates of the expected benefits and costs to society that are incident to achieving the stated objectives of the function. The costs and benefits will be exhaustive and may cover multiple government agencies and budgets. Define costs and benefits so they are mutually exclusive.

(a) In accordance with Reference (c), a DoD economic analysis should include comprehensive estimates of societal costs and benefits both inside and outside the Federal Government. A project whose primary purpose is to produce benefits outside the Federal Government is analyzed pursuant to the “Special Guidance for Public Investment Analysis.” section of Reference (c).

(b) Sunk costs and realized benefits are not included in the comparison of alternatives. Sunk costs and realized benefits should be discussed in the assumptions for the analysis. Sunk costs should not be excluded should there be a requirement to reflect the total program costs. If required, sunk costs should be specifically identified as such, but not included in the decision making or recommending evaluation criteria.

(c) When the magnitude and timing of a cost or benefit is identical for all alternatives, they can be considered as “common costs” or benefits.

1. Common costs do not add any additional information to the decision-making process and may be excluded from the comparison.

2. Caution should be taken when identifying common costs to confirm that costs or benefits excluded are identical for all alternatives. Additionally, common costs should not be excluded should there be a requirement to reflect the total program costs.

(d) Include the opportunity cost of assets and resources.

1. Opportunity costs represent the alternative value foregone when an asset is used for other purposes.

2. If an alternative requires that the government retain an asset, the opportunity cost would be the estimated value of the asset.

(e) If appropriate, analysis should account for recurring costs, nonrecurring costs, and imputed costs.

(f) Residual values should be calculated for alternatives that have assets (buildings, equipment, structures, etc.) that will still have useful life at the end of the period of analysis. That value should reflect the remaining worth of the asset(s) in question at the end of the period of analysis.

1. Market appraisal for similarly-aged assets, appraisal guidelines, and depreciation schedules are all acceptable techniques.

2. Land is an asset that is expected to appreciate, rather than depreciate, over time.

3. Terminal value estimates for land can be based on a market study. If that is not possible, assume land will appreciate at a real rate of 1.5 percent each year.

(2) Estimation of Costs and Benefits. The adequacy or success of costing efforts depends primarily on establishing relationships between the attributes and the cost elements of an alternative.

(a) Cost estimating techniques fall into the four categories of “analogy,” “parametric cost estimating,” “engineering,” and “actual cost.”

(b) Cost estimating techniques establishing those relationships should be based on the amount and detail of data available as well as the time and resources at hand to develop the cost estimates.

(c) The selection of a cost estimating technique depends on the data available.

(3) Timing of Costs and Benefits. Accounting for the time value of money is crucial to the conduct of an economic analysis. Economic analyses must accurately reflect the time when costs and benefits occur. A cost in an economic analysis is discounted in the year in which the Federal Government is expected to incur an expense; a benefit is discounted in the year in which the Federal Government expects to realize the benefit.

c. Treatment of Inflation. All budget estimates must be in current (also known as “Then Year”) dollars. For analytical purposes, all estimates of the costs and benefits for each year of the period of analysis can be made in either of two ways:

(1) Constant dollars that measure costs and benefits for stable purchasing power; or

(2) Current dollars that measure costs and benefits for future purchasing power of the dollar. In a single analysis, computations should not mix current and constant dollars.

d. Discounting. The discount rate to be used for conducting economic analysis in the DoD is based on an estimate of the government’s costs of borrowing for the appropriate period of analysis.

(1) The proper discount rate to use depends on whether the costs and benefits are measured in current or constant dollars.

(a) If costs and benefits are expressed in constant dollars, then a real discount rate, i.e., a nominal rate that has been adjusted to exclude expected inflation, should be used to calculate a net present value.

(b) If costs and benefits are measured in current dollars, then a nominal discount rate (which implicitly includes inflation) should be used to calculate the net present value.

(2) The estimate of the discount rate for use in DoD economic analysis expressed either in real or nominal terms will be issued annually by OMB in Appendix C to Reference (c). These data will be based on estimates of real and nominal borrowing rates provided by the OMB in accordance with Appendix 3 to this enclosure.

(3) Discount rates will be based on an estimate of the expected cost of borrowing for 3-, 5-, 7-, 10-year, and longer-term securities. Appendix 3 of this enclosure shows the procedures to use in applying the discount rates.

Appendixes

1. Sensitivity Analysis
2. Special Procedures for Leasing
3. Determining the Discount Rate for Performing Economic Analysis of Investment Alternatives

APPENDIX 1 TO ENCLOSURE 2

SENSITIVITY ANALYSIS

1. GENERAL. Uncertainty is always present in economic decision-making. Therefore, to determine the effects of uncertainties, a sensitivity analysis should be performed.

a. Type. Sensitivity analysis is a repetition of an analysis with different quantitative values for cost or operational assumptions to determine their effects for comparison with the results of the basic analysis.

(1) It is a tool that can be used for assessing the extent to which costs and benefits are sensitive to changes in key factors.

(2) Sensitivity analyses conducted on major unknowns for each possible alternative can provide a range of costs and benefits that may provide a better guide or indicator than a single estimate.

b. Uses. A sensitivity analysis is basically a “what-if” exercise. It tests whether the conclusion of an economic analysis will change if a cost, benefit, or other assumed variable changes. Sensitivity analyses should always be performed when the results of the economic analysis do not clearly favor any one alternative or when there is uncertainty about an assumption that could affect the estimate of costs and benefits in the economic analysis.

c. Factors. Sensitivity analyses can be performed on all possible alternatives by describing the approach and assumptions used for conducting the sensitivity analysis and describing the factors that have been determined to warrant sensitivity analysis. Examples of factors to consider are:

(1) Assumptions. Consider the effects of alternative assumptions:

(a) The project objective.

(b) Requirements.

(c) Operations.

(d) Discount rate.

(e) Inflation.

(f) Residual value.

(2) Period of Analysis. Consider the effects of a shorter or longer economic life.

(3) Costs and Benefits. Consider changes in the magnitude and timing of cost or benefits. Costs or benefits that significantly affect the total net present value of an alternative are good candidates for sensitivity analysis.

d. Results. If a change in a variable or assumption causes a change in the ranking of alternatives, the economic analysis is said to be sensitive to that variable or assumption. Performing a sensitivity analysis and including its results in the report provides a level of assurance that uncertainties have been tested and the results documented.

2. RISK ANALYSIS. Sometimes a risk analysis can be justified. The more explicitly the risk is defined, the greater the possibility for the decision-maker to confidently use the analysis. The probability results of available choices should be described as definitively as possible. Many statistical and other tools exist so that a quantitative risk assessment can be made.

APPENDIX 2 TO ENCLOSURE 2

SPECIAL PROCEDURES FOR LEASING

1. LEASING. The special guidance in this appendix applies only to analyses that include a possible leasing alternative. All costs for both lease and purchase alternatives should be handled in a consistent and fair manner.

a. Coverage. This special guidance applies when any of these conditions are satisfied:

(1) 3 Year Lease. The asset is leased to the DoD for a period of 3 or more years;

(2) Leased New. The asset to be leased is new, with an economic life of less than 3 years, and leased to the DoD for a term of 75 percent, or more, of the economic life of the asset;

(3) Purpose-Driven Lease. The asset is built for the express purpose of being leased to the DoD; or

(4) Specified Lease. The asset is leased to the DoD and clearly has no alternative commercial use (e.g., a special purpose government installation).

b. Analytical Requirements and Definitions. When a DoD activity needs to acquire the use of a capital asset, it should do so in the way that has the least expensive life-cycle cost to the government.

(1) Life-Cycle Cost. If the set of alternatives includes both lease and purchase alternatives, the analysis should compare the net discounted present value of the life-cycle cost of leasing with the full cost of buying or constructing a comparable asset. The full costs of buying include the asset's purchase price plus the net discounted present value of any relevant ancillary services for the purchase and imputed costs.

(2) Taxes. In analyzing the cost of a lease, the normal payment of taxes on the lessor's income from the lease should not be subtracted from the lease costs since the normal payment of taxes will also be reflected in the purchase cost.

(a) The cost to the U.S. Treasury of special tax benefits, if any, associated with the lease should be added to the cost of the lease.

(b) Examples of such tax benefits might include highly accelerated depreciation allowances or tax-free financing.

(3) Ancillary Costs. If the terms of the lease include ancillary services provided by the lessor, the present value of the cost of obtaining those services separately should be added to the purchase price. Examples of ancillary costs include:

(a) Repair and improvement costs (if included in lease payments).

(b) Operation and maintenance costs (if included in lease payments).

(4) Estimating Imputed Costs. Certain costs associated with the federal purchase of an asset may not involve a direct monetary payment. Some of those imputed costs may be estimated as follows:

(a) Purchase Price. An imputed purchase price for an asset that is already owned by the Federal Government, or which has been acquired by donation or condemnation, should be based on the estimated value of similar properties that have been traded on commercial markets in the same or similar localities. The same method should be followed in estimating the imputed value of any federal land used as a site for the asset.

(b) Property Taxes. Imputed property taxes may be estimated in two ways:

1. Determine the property tax rate and assessed (taxable) value for comparable property in the intended locality. If there is no basis on which to estimate future changes in tax rates or assessed values, the first-year tax rate and assessed value (if costs are expressed in nominal dollars, inflation adjusted for each subsequent year) can be applied to all years. Multiply the assessed value by the tax rate to determine the annual imputed property taxes; or

2. Get an estimate of the current local effective property tax rate from the Building Owners and Managers Association's Experience Exchange Reports, available at <http://www.boma.org/research/Pages/default.aspx>. Multiply the fair market value of the government-owned property (if costs are expressed in nominal dollars, inflation adjusted for each year) by the effective tax rate.

(c) Insurance Premiums. Determine local estimates of standard commercial coverage for similar property from Building Owners and Managers Association's Experience Exchange Reports, available at <http://www.boma.org/research/Pages/default.aspx>.

APPENDIX 3 TO ENCLOSURE 2

DETERMINING THE DISCOUNT RATE FOR PERFORMING ECONOMIC
ANALYSIS OF INVESTMENT ALTERNATIVES

1. DISCOUNT RATE. The discount rate for use in DoD economic analyses is based on the U.S. Treasury Department's cost of borrowing funds. Annually, the OMB issues an update of the borrowing rates based on the estimates provided in the President's budget submission.

2. ANNUAL UPDATES. The OMB typically issues updated rates each February. Current and historical rates can be found at
http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c/

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3. DISCOUNT RATE FORMULAS. See the Figure below.Figure. Discount Factor Methodology

The methodology for calculating end-of-year discount factors associated with the various discount rates is based on the formula:

$$F_n = 1/(1 + i)^n$$

where: F_n = the present value factor for year n

i = the discount rate

n = the project year

For example, if the current year (nominal) discount rate for a project of four years or fewer is 1 percent, the calculation of the discount factors for the 3 years of a 3-year project for current dollars is:

$$F_1 = 1/(1 + 0.01)^1 = 0.9901$$

$$F_2 = 1/(1 + 0.01)^2 = 0.9803$$

$$F_3 = 1/(1 + 0.01)^3 = 0.9706$$

When costs and benefits occur in a steady stream, applying mid-year factors is best for the analysis. The formula for the calculation of the mid-year discount factors is $F_n = 1/(1 + i)^{(n - .5)}$

For example, if the current year (nominal) discount rate for a project of four to six years is 1.9 percent, the calculation of the midyear discount factors for the 5 years of a 5-year project using current dollars is:

$$F_1 = 1/(1 + 0.019)^{.5} = 0.9906$$

$$F_2 = 1/(1 + 0.019)^{1.5} = 0.9722$$

$$F_3 = 1/(1 + 0.019)^{2.5} = 0.9540$$

$$F_4 = 1/(1 + 0.019)^{3.5} = 0.9362$$

$$F_5 = 1/(1 + 0.019)^{4.5} = 0.9188$$

ENCLOSURE 3

DEAC

1. GENERAL. DEAC serves in an advisory capacity to the DCAPE and encourages DoD-wide application of the concepts contained in this instruction in the planning, programming, and budgeting processes. DEAC also:

a. Develops DoD-wide standardized format and documentation requirements and identifies support tools to confirm consistent, complete economic analysis submissions.

b. Establishes guidelines to review and retain results of the economic analysis, including assumptions, calculations, source data, and decisions resulting from the analysis.

c. Serves to strengthen analytical capabilities throughout DoD.

2. COUNCIL APPOINTEES. The OSD Principal Staff Assistants, the Military Departments, and the Defense Agencies will each appoint one representative to DEAC. The Director, Operational Test and Evaluation shall not appoint a representative to DEAC.

3. COUNCIL RESPONSIBILITIES. DEAC members are responsible for advising the DCAPE and their respective organizations on:

a. Policies and procedures regarding the use of economic analysis and the application and revision of this instruction.

b. The application of economic analysis in the planning, programming, budgeting, and evaluation process, and other decision-making processes of the DoD.

c. Techniques and methodology for justifying and supporting resource consumption decisions.

d. Educational programs for fostering and understanding techniques of analysis and enhancing their usefulness to managers and operations personnel.

e. Improving the quality of analysis and strengthening DoD analytical capabilities.

4. COUNCIL CHAIR. A Chair is approved by the DCAPE based on recommendations from the Council members.

GLOSSARY

PART I. ABBREVIATIONS AND ACRONYMS

DCAPE	Director of Cost Assessment and Program Evaluation
DEAC	Defense Economic Analysis Council
DoDD	DoD Directive
OMB	Office of Management and Budget
USD(C)/CFO	Under Secretary of Defense for (Comptroller)/Chief Financial Officer of the Department of Defense

PART II. DEFINITIONS

These terms and their definitions are for the purpose of this instruction.

base year. The year to which all costs and benefits are discounted.

economic analysis. A systematic approach to the problem of choosing the best method of allocating scarce resources to achieve a given objective. Economic analysis includes consideration of costs, benefits, risk, and uncertainty.

economic life. The period of time when the benefits from an alternative are expected to accrue. The economic life is set by the shortest of its physical life, mission life, or technological life.

imputed costs. The analysis should incorporate, as costs, the value of any federal services provided without charge to the project (e.g., base operating support).

lead time. The period from the start year to the time that an alternative begins to produce benefits.

mission life. The estimated number of years over which the need for the asset is anticipated.

nonrecurring costs. Often one-time costs or costs that occur on an infrequent and intermittent basis.

period of analysis. The economic life of the program or project plus the lead time.

physical life. The estimated number of years that an asset can physically be used in accomplishing the function for which it was intended.

present value. A future amount of money that has been discounted to reflect its current value.

realized benefits. A benefit that has already been collected. Because they are already captured, realized benefits are not relevant to prospective investment decisions that are made after the realized benefits have been collected.

recurring costs. Those costs incurred on a continuing annual basis to support the alternative. Those can often be grouped into such categories as “personnel,” “utilities,” “maintenance,” “overhead,” etc.

risk analysis. An analysis of the probabilities of errors in the estimates or the probabilities of occurrence of events.

start year. The first year in which an alternative incurs a non-sunk cost or realizes a benefit. The start year is the first year of the period of analysis.

sunk costs. A cost that has already been incurred and cannot be recovered. Sunk costs are not relevant to prospective investment decisions that are made after the sunk costs have been incurred because they are irretrievable.

technological life. The estimated number of years a facility or piece of equipment will be used before it becomes obsolete due to changes in technology.