Appendix D Economics Guidebook Glossary

Benefits

Benefits are the values of goods and services produced by the project. Different types of benefits include:

- Primary vs. secondary: *primary benefits* are the increased values of goods or services and/or the reduction in costs, damage, or losses to those directly affected by the project (primary beneficiaries). *Secondary (indirect) benefits* are the net values that accrue to persons other than primary beneficiaries as a result of economic activity induced by or stemming from a project. Generally only primary benefits are included in benefit/costs analyses.
- Tangible vs. Intangible: *tangible benefits*, either primary or secondary, can be expressed in monetary terms. *Intangibl*e benefits can not be expressed in monetary terms.
- Private vs. public: *private benefits* are obtained from goods and services purchased by individual producers and consumers through markets. *Public benefits* are obtained from providing "public" goods and services, i.e., goods that are consumed by society as a whole (national defense, police protection, highways, parks, etc.). Consumption of these goods by one individual does not preclude consumption by other individuals.

Benefit-Cost Analysis

A type of economic analysis that identifies and measures (usually in monetary terms) the different primary benefits and costs of proposed projects and then compares them with each other to determine if the benefits of the project exceed its costs over the analysis period. Benefit-cost analysis is the principal method used to determine if a project is economically justified. Benefit-cost comparisons of projects are most commonly made using these criteria:

- Net benefits: determined by estimating discounted benefits and costs over the study period, and then subtracting discounted costs from the discounted benefits. The optimum scale of development for a project occurs where net benefits are at a maximum. However, the net benefit criterion does not take into account the absolute level of costs involved to achieve project benefits, thus it is most appropriately used when comparing projects of similar sizes and objectives.
- Benefit/cost ratio: determined by dividing discounted benefits by discounted costs. A project is economically feasible if its B/C ratio is greater than 1.00. The B/C ratio is a measure of relative rather than absolute merit, thus it can be used to select from projects of different scales and objectives. However, the most economic use of a resource rarely occurs at the scale of development where the B/C ratio is at maximum. Thus, a net benefit analysis may be needed to size an alternative once it is selected using the B/C ratio.
- Internal rate of return: determines the rate of return, or discount rate, which just equates project discounted benefits with discounted costs. If the computed rate of return is greater than a specified discount rate, then the project is determined to be economically efficient. Although the IRR criterion usually produces the same result as the net benefits or B/C ratio criteria, it is possible for the IRR to compute more than one solution depending upon the time stream of benefits and costs.

California Agriculture Model
A DWR PC-based regional mathematical programming model of irrigated agriculture production and economics that simulates the decisions of agricultural producers in California. CALAG is an expanded version of an earlier model, Central Valley Production Model.

Consumer Surplus
The value consumers place on goods in excess of prices paid for those goods and it is graphically shown as the area under a demand curve but above the market equilibrium price determined by the intersection of the demand and supply curves.

Contingent Valuation/Choice Methods
Survey methods used to determine people's willingness to pay for goods and services in the absence of market data. Contingent valuation surveys ask how much people would be willing to spend for specific goods and services. Contingent choice surveys ask people to state preferences for different goods and services based upon their costs. An alternative application of this method is to ask people how much they would be willing to accept in order to give up a specified amenity or benefit.

Costs
All costs necessary to obtain project benefits over the analysis period. Conceptually, all costs in the economic analysis should reflect the opportunity costs of using resources to construct and operate the project. Practically, however, the cost information used in the analysis is often limited to the actual purchase expenditures which are used in financial analyses:

- Capital: expenditures necessary to complete the project so operations can commence. Capital costs (e.g., construction, "fixed" or "first" costs) include expenditures for land, structures, materials, equipment, and labor, as well as allowances for contingencies. Financial costs (such as interest during construction and long-term debt service interest) are not included, although they are important in a financial analysis.
- Operation, maintenance and replacement: include the project's annual administrative, maintenance, energy and replacement costs and are often called "variable costs" because they vary with different levels of project output.

Cost Allocation
Cost allocation is the process by which financial costs of a project are distributed equitably among project purposes. A common cost-allocation method is Separable Costs-Remaining Benefits which distributes costs among the project purposes by identifying separate costs and allocating joint costs or joint savings in proportion to each purpose's remaining benefits.

Cost-Effectiveness Analysis
A type of economic analysis that identifies the least costly method for achieving specific physical objectives. Cost-effectiveness analysis is often used to evaluate projects in which the outputs can not easily be expressed in monetary terms (for example, projects that produce ecosystem benefits). Cost-effectiveness analysis can also be combined with incremental cost analysis to measure changes in costs and outputs among alternative plans.

Crop Budgets
Descriptions of hypothetical farm sizes for various crops, "sample" establishment/production operating and overhead costs, yields, and prices received by growers. The University of California Crop Extension Office publishes budgets for crops throughout the state.

Demand Curve
A graphical representation of the amount of a good demanded at different prices with prices plotted on the vertical (y) axis and quantity purchased on the horizontal (x) axis. Demand curves generally slope downward (to the right) because people generally purchase less of a good as its price increases.

Discounting
A process used to adjust for the time value of money. Even if there is no inflation, a dollar received today is worth more than one received in the future because a dollar received today can be put to immediate use. Adjusting for different time periods is accomplished by estimating the present value of each benefit and cost in the future. Present values are calculated with a simple formula ($P = F / (1 + r)n$), which involves dividing the future dollar amount of benefit or cost by a discount factor $(1 + r)$ raised to the nth power. In this equation, P equals the present value of the future cash flow, F = future cash flow, r = discount rate, and n = number of time periods into the future that the benefit or cost occurs. Alternatively, present value "factors" for different discount rates and analysis years may be found in financial tables. All annual costs and benefits are discounted using the same discount rate and total discounted benefits and costs can then be summed for the entire analysis period and directly compared to each other.

Discount Rate
The discount rate is used to adjust dollars received or spent at different times to dollars of a common value, usually present day dollars ("present worth" or "present value"). Although there are different methods for determining discount rates, generally the value to use for this rate for an economic analysis is the real (i.e., excluding inflation) rate of return that could be expected if the money were instead invested in another project. In other words, the discount rate is a measure of forgone investment (i.e., "opportunity cost") if the money allocated to the project were instead invested elsewhere.

Economic Analysis
Determines if a project represents the best use of resources over the analysis period and is therefore economically justified. The economic analysis answers questions such as: should the project be built at all, should it be built now, or should it be built to a different configuration or size? A project is economically justified if its expected total discounted benefits exceed project discounted costs over the analysis period. The comparison of benefits and costs must be done using with and without project conditions and not before and after conditions.

Ecosystem
An interdependent community of plants and animals interacting with one another and with the chemical and physical factors making up their environment.

Ecosystem Functions
The self-sustaining processes (physical, chemical and biological) of an ecosystem, many of which result in services that have value to humans.

Ecosystem Services
In addition to providing services for plant and animal life, ecosystems provide goods and services which are valuable to humans, including improved water supply and quality, flood damage reduction, recreation, scientific investigation and commercial products (fish, berries, wood products, etc.).

Ecosystem Structure
Includes all of an ecosystem's complex physical and socioeconomic characteristics.

Ecosystem Valuation Methods
Methods to estimate consumers' "willingness to pay" for ecosystem goods and services not normally found in the marketplace. Four general types of methods can be used:

- Revealed willingness to pay: measures value of ecosystem goods and services based upon actual prices paid for these products or related goods and services (using hedonic pricing and travel cost methods).
- Imputed willingness to pay: measures value of ecosystem goods and services based upon the (1) cost of avoiding damage caused by the loss of these services, (2) cost of replacing ecosystem services, or (3) cost of providing substitute services.
- Expressed willingness to pay: measures value of ecosystem goods and services based upon consumer surveys (using contingent valuation/choices methods).
- Benefit transfers: measures value of ecosystem goods and services by transferring available information from studies already completed in another location and/or context.

Externalities
Costs (or benefits) imposed upon others from the activities of producers or consumers for which no compensation is received.

Federal *Circular* A-94
Economic analyses conducted by non-water and related land resource federal agencies must follow this document issued by the President's Office of Management and Budget which provides guidance for conducting benefit/cost and cost-effectiveness analyses. Water and land resource federal agencies (such as the Corps and Bureau) must follow the *Principles and Guidelines*.

Federal Decision Criteria
The federal *Principles and Guidelines* identify four broad decision criteria for the evaluation of all federal plans:

- Completeness: the extent to which a given plan has all the necessary investments and other actions to ensure the realization of the planned effects.
- Effectiveness: the extent to which an alternative plan accomplishes its planning objectives.
- Efficiency: the extent to which an alternative plan is the most cost-effective means of accomplishing its planning objectives and is the criteria which is addressed by the economic analysis.
- Acceptability: the workability and viability of the alternative plans with respect to acceptance by state and local entities and the public as well as compatibility with existing laws, regulations, and public policies.

Project *justification* is determined by how well a proposed project meets all four criteria.

Federal Objective

The federal *Principles and Guidelines* state that the federal objective of water and related land resources planning is to contribute to national economic development (NED) consistent with protecting the Nation's environment, in accordance with national environmental statues, applicable executive orders, and other federal planning requirements.

Federal Planning Accounts

The federal *Principles and Guidelines* establish four planning accounts to facilitate project planning:

- National Economic Development (NED): displays contributions to national economic development which are increases in the net value of the national output of goods and services, expressed in monetary units, and which are the direct net benefits that accrue in the planning area and the rest of the Nation.
- Environmental Quality (EQ): displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans (discussed below).
- Regional Economic Development (RED): displays changes in the distribution of regional economic activity (e.g., income and employment).
- Other Social Effects (OSE): displays plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation and other effects.

Display of the national economic development and environmental quality accounts is required whereas display of the other two accounts is discretionary.

Federal Planning Process

The federal planning process consists of six steps as described in the *Principles & Guidelines*: (1) specification of water and related land resources problems and opportunities; (2) inventory, forecast and analysis of water related land resources within the study area; (3) identification of alternative plans; (4) evaluation of the effects of alternative plans; (5) comparison of the alternative plans; and (6) selection of the recommended plan based upon the comparison of the alternative plans. *Plan formulation* consists of the third, fourth and fifth planning steps. It is a highly iterative process that involves cycling through the formulation, evaluation, and comparison steps many times to develop a reasonable range of alternative plans and then narrow those plans down to a "final array" of feasible plans from which a single plan can be identified for implementation.

Federal Plans

The criteria for selecting the recommended federal plan differ depending on the type of plan. While the NED Plan is common to all agencies that follow the P&G, the Corps has authority to implement other plans as well:

- National Economic Development Plan: for single project purposes, such as water supply or flood damage reduction where project outputs can be measured in dollars, project selection is based on maximizing net monetary benefits.
- National Ecosystem Restoration Plan: the Corps incorporated ecosystem restoration as a project purpose in response to the increasing national emphasis on environmental restoration and preservation; however, the Corps does not place monetary values on ecosystem benefits. The Bureau does not have authority for national ecosystem restoration plans (as of September 2005).

- Combined NED/NER Plan: Corps' projects that produce both NED and NER benefits will result in a "best" recommended plan so that no alternative plan has a higher excess of NED monetary benefits plus NER non-monetary benefits over project costs. This plan shall attempt to maximize the sum of net NED and NER benefits and to offer the best balance between two federal objectives.
- Locally Preferred Plan: Projects may deviate from the NED, NER or combined NED/NER Plans if requested by the non-federal sponsor. For example, if the sponsor prefers a more costly plan and the increased scope of the plan is not sufficient to warrant full federal participation based on the NED analysis, the Locally Preferred Plan may be approved as long as the sponsor pays the difference in costs between the NED (or NED/NER) plans and the LPP.

Federal *Principles and Guidelines*

Economic analyses conducted by federal agencies working with water and related land resource problems (such as the Corps and the Bureau) must follow the *Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* published by the Water Resources Council in March, 1983. The first "principles" part of the *P&G* establishes project planning policies to be followed whereas the second "guidelines" part describes "how to" procedures.

Financial Analysis

Determines if project beneficiaries are willing and able to raise sufficient funds to construct and operate a project over its repayment period. The financial analysis answers questions such as: who benefits from a project, who will repay project costs and will they be able to meet repayment obligations? A project is financially feasible if beneficiaries are able to pay for reimbursable costs over the repayment period, sufficient capital is authorized and available to finance construction to completion, and estimated revenues are sufficient to cover reimbursable costs over the repayment period.

Forgone Investment Value

If construction occurs over several years, then the future value of these expenditures must be determined in an economic analysis by multiplying these monetary costs by a future value factor (which is the reciprocal of the present value factor). These future value adjustments reflect the value of other investments that could have been pursued if the project were not undertaken ("opportunity costs"). Forgone investment value is often erroneously called "interest during construction" which is the financial interest paid on borrowed funds during construction.

Hedonic Pricing Method

This method can be used to estimate economic benefits associated with environmental amenities (such as aesthetic views or proximity to recreational sites) or environmental costs (such as the effects of air, water or noise pollution). Most hedonic price applications use differences in residential housing prices to estimate the value of the environmental amenities.

Incremental Cost Analysis

Incremental cost analysis computes the change in cost per unit of output that results from different sizes of project alternatives. This analysis determines which alternative has (a) the greatest increase in output for the least cost increase and (b) the lowest incremental costs per unit of output relative to other cost-effective plans.

Input/Output Analysis
A quantitative description of the relationship among industries within an economy which shows the interdependence among various sectors of the economy as they combine to meet a given final demand for goods and services.

Interest During Construction
The financial compound interest paid on borrowed funds during construction.

Least Cost Planning Simulation Model
A DWR PC-based simulation/optimization model that assesses the economic benefits and costs of increasing urban water reliability at the regional level.

Life Cycle Cost Analysis
Life-cycle cost analysis (LCCA) is a method for assessing and comparing the total costs of alternatives. It takes into account all costs of acquiring, owning, and disposing of facilities and related equipment. LCCA is especially useful when project alternatives that fulfill the same performance requirements, but differ with respect to initial costs and operating costs, have to be compared in order to identify the one that maximizes net cost savings. The three key variables in a LCCA include identifying and evaluating for each alternative all pertinent costs, the period of time over which these costs can be compared, and the appropriate discount rate.

Mathematical Programming
A mathematical solution to an objective function (such as maximizing or minimizing a specific variable) subject to a set of constraints. A common mathematical programming tool is linear programming, whose objective function and constraint equations are expressed as linear relationships.

Net Crop Revenue Model
A DWR PC-spreadsheet program which estimates average net crop revenues for important crops for recent years in California counties and regions.

Opportunity Costs
The value of productivity forgone by not investing a resource in the next optimal project.

Payment Capacity
A measure of the maximum ability of most agricultural producers in a specific area to pay for water at their head gate, on a per acre-foot basis, over a specified period. Payment capacity is the difference between gross returns from the sale of crops and the costs of production (including an imputed cost for the grower's own labor and management), excluding the cost of water.

Planning Time Horizons

Different planning time horizons may be used for feasibility analyses:

- Economic life: The period in which the project is economically viable, which means that the incremental benefits of continued use exceed the incremental costs of that use.
- Physical life: The period in which the project can no longer physically perform its intended function. Economic life may be shorter than physical life but not vice versa.
- Analysis period: The length of time over which a project's consequences are included in a study. Typical analysis periods for structural water resource projects are 50 to 100 years and 5 to 25 years for nonstructural projects.
- Short- vs. long-term: Short-term is the period of time in which capital investments cannot be changed, compared to the long-term in which new capital investments can be undertaken.
- Financing period: The length of time required for bond repayment or other required paybacks, which may be shorter or longer than the period of analysis. This time horizon is only relevant for financial analyses.

Producer Surplus

This is the benefit producers receive if prices received for goods exceed production costs for those goods. This value is graphically shown as the area above a supply curve but less than the market equilibrium price determined by the intersection of the demand and supply curves.

Regression Analysis

Statistically assesses the relative contribution of one or more independent variables upon a dependent variable.

Risk

The probability that some undesirable event will occur which is usually linked with a description of the corresponding consequences of that event.

Socioeconomic Impact Analysis

A type of economic analysis that focuses upon changes in regional population, secondary economic and fiscal effects expected to occur from proposed projects. Results from socioeconomic impact analyses are often included in environmental impact studies/reports and, for federal studies, are included in the Regional Economic Development and/or Other Social Effects planning accounts.

Supply Curve

A graphical representation of the amount of a good produced at different process with prices plotted on the vertical (y) axis and quantity produced on the horizontal (x) axis. Supply curves generally slope upward (to the right) because suppliers generally produce more of a good as its price increases.

Total Surplus

The sum of consumer and producer surplus minus any associated production costs which represents the total economic value of a good.

Trade-off analysis

Displays all monetary and non-monetary effects of a project such that the "gains and losses" among different plans can be identified.

Travel Cost Method
Used to estimate the value of recreational and/or ecosystem benefits assuming that the time and travel costs people incur to visit sites can be used as indicators of their willingness to pay for benefits obtained at those sites.

Uncertainty
Situations without sureness, whether or not described by a probability distribution.

Willingness to Accept
The amount of money that an individual would be willing to accept as payment in order to forego a good or service.

Willingness to Pay
The amount of money that an individual would be willing to pay for a good or service, which indicates the benefit of that good to that individual.

Without vs. With Conditions
Economic analysis (as well as all aspects of project evaluation) must focus upon the change in conditions expected to occur "without" the project vs. "with" the project. The "without" project conditions, which not only include historical and existing conditions but also future without project conditions, become the baseline from which all project effects (positive and negative) are compared. Thus, the estimation of the existing and future without project conditions is a critical step in the economic analysis. Often the "without" vs. "with" comparison is confused with a "before" and a "after" comparison, but this is not correct because some of the benefits forecasted to occur in the future with the project may also have occurred even without the project and therefore they should not be attributed to the project.