

# Economic Evaluation

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# Menti time!

- What comes to mind when you think of Economics? Or Economics Evaluation?



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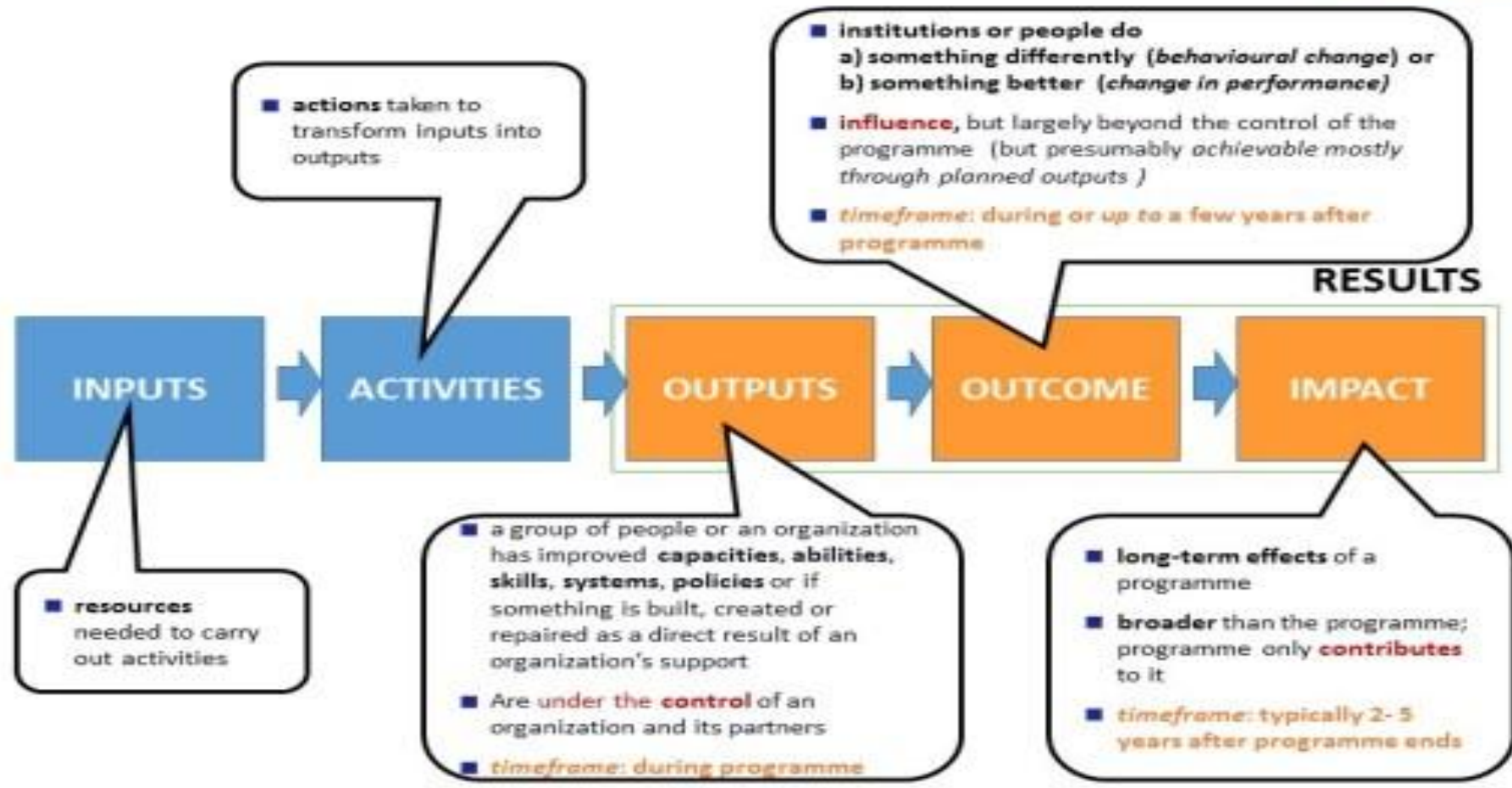
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# Outline

- **Program Evaluation vs Economic Evaluation**
  - Theory of Change / logic framework perspective
- **Major themes in Economic Evaluation**
  - Definitions and claims
  - Goals: Efficiency vs Equity
- **Cost Benefit Analysis**
  - Steps with an example
  - Challenges with Economic Evaluation

# RESULT CHAIN



# Economic Evaluation vs Program Evaluation

<b>Dimension</b>	<b>Program Evaluation (PE)</b>	<b>Economic Evaluation (EE)</b>
<b>Core Questions</b>	What works?	Is it worth it?
<b>Focus</b>	Results Chain (Processes + outcomes)	Costs vs benefits
<b>Scope</b>	Broad (implementation, context, outcomes)	Narrow (static technical exercise)
<b>Orientation</b>	Journey + destination	Destination (net value)
<b>Methods</b>	Qualitative + quantitative	Quantitative (often monetized)
<b>Output</b>	Insights, learning, improvement	Decision rule (NPV, cost-effectiveness)
<b>Role</b>	Understand programs	Compare alternatives

# Why Programs Exist?

- **Efficiency** seek to improve/supplement private decisions to increase general economic welfare
  - **Market Failure, Public Goods, Externalities, Competition Policy, Economic Development**
- **Equity** seek to make the economy more equitable to improve the fairness of the market economy
  - **Quality of life, Nationalism, Fairness**
  - **Process vs Outcomes**

## Claims/Recommendations

- **Positive** offers a description of *what is* – *how resources **are** be allocated*
- **Normative** offers an assessment of *what ought to be* - *how resources **should** be allocated*

# Economic (Cost-Benefit Analysis) principles

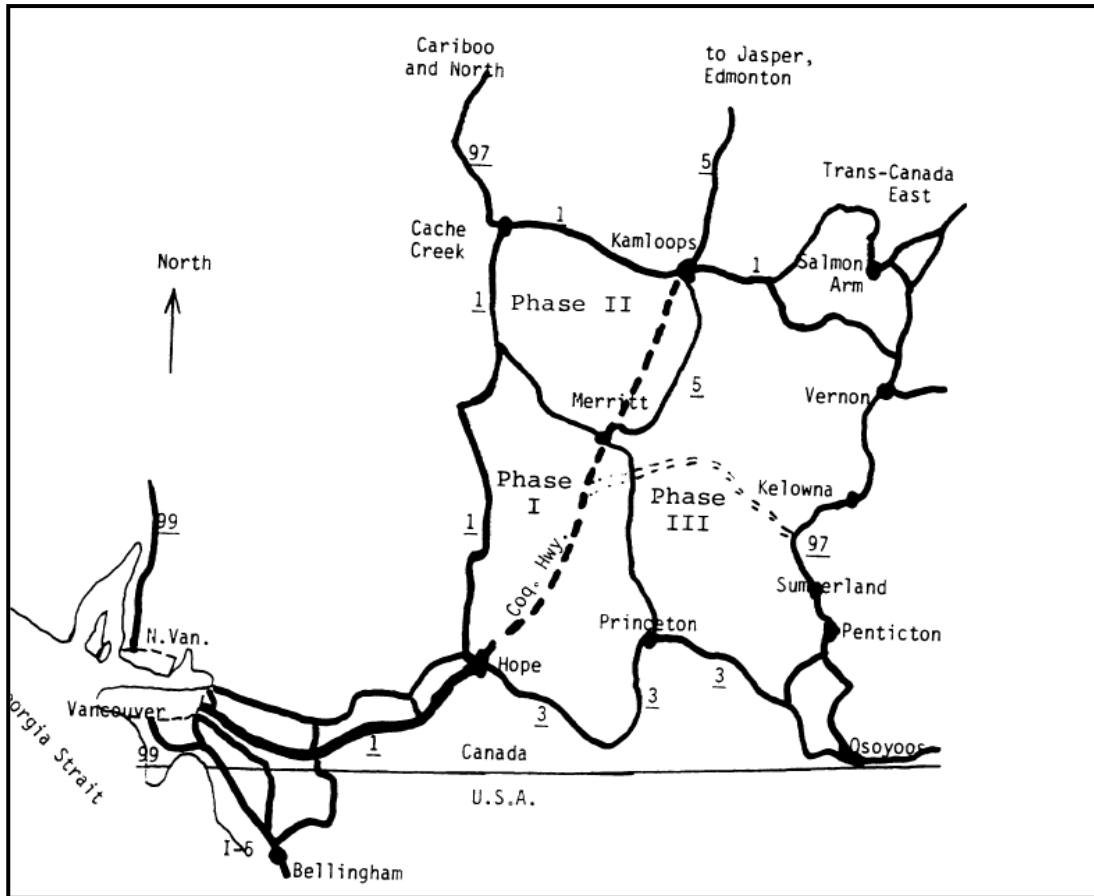
## Principles

- People respond to incentives
- No free lunch – everything has a cost.
- Everything is a duality. Payment for a phone (cost to me) is income to someone else.
- Any action has a ripple effect extended beyond the immediate actors.
- With intended come unintended consequences.
- Controlling all possible outcomes is impossible.

- **Rationality:** People try to make decisions using a logical process:
  - State a clear objective
  - Enumerate all possible options for a solution
  - Evaluate the costs and benefits of each
  - Select the “best”
- **Optimality** as the “best”.
- **Marginal analysis** – balancing incremental cost against incremental benefit is the path to optimality
- Individual vs Social Costs and Benefits

# Coquihalla Highway Example

- **Issue:** The Coquihalla Highway replaced a notoriously difficult highway from Hope to Merritt to Kamloops.
- **Benefits:** It was safer and reduced travel time.



Boardman et. al. *Cost-Benefit Analysis: Concepts and Practice*, 4 ed. Prentice Hall (2011)

# Steps in CBA: Coquihalla Highway

## 1. Specify the set of Alternative projects

- Two Alternative highways – with and without tolls
  - Status quo (existing road as reference point)
- Dimension: road surface, routing, size, tolls, wild-animal friendliness, timing
  - Why This Dimension Matters
  - Status Quo not always a viable alternative
- Limitations to Alternatives – comparability ( $k^n$ )

## 2. Decide whose benefits and costs count (standing)

- Who is a legitimate stakeholder?
- How much should the views of each stakeholder count?
  - Provincial vs Global
- Contentions about perspectives
  - Environmental
  - Guardians vs Spenders

# Coquihalla Highway Example

**TABLE I-3** Coquihalla Highway CBA (1986 \$ Million)

	<i>No Tolls</i>		<i>With Tolls</i>	
	<i>A Global Perspective</i>	<i>B Provincial Perspective</i>	<i>C Global Perspective</i>	<i>D Provincial Perspective</i>
<b>Project Benefits:</b>				
Time and Operating Cost Savings	389.8	292.3	290.4	217.8
Horizon Value of Highway	53.3	53.3	53.3	53.3
Safety Benefits (Lives)	36.0	27.0	25.2	18.9
Alternative Routes Benefits	14.6	10.9	9.4	7.1
Toll Revenues	—	—	—	37.4
New Users	0.8	0.6	0.3	0.2
<b>Total Benefits</b>	<b>494.5</b>	<b>384.1</b>	<b>378.6</b>	<b>334.7</b>
<b>Project Costs:</b>				
Construction	338.1	338.1	338.1	338.1
Maintenance	7.6	7.6	7.6	7.6
Toll Collection	—	—	8.4	8.4
Toll Booth Construction	—	—	0.3	0.3
<b>Total Costs</b>	<b>345.7</b>	<b>345.7</b>	<b>354.4</b>	<b>354.4</b>
<b>Net Social Benefits</b>	<b>148.8</b>	<b>38.4</b>	<b>24.2</b>	<b>-19.7</b>

*Source:* Adapted from Anthony Boardman, Aidan Vining, and W. G. Waters II, "Costs and Benefits through Bureaucratic Lenses: Example of a Highway Project," *Journal of Policy Analysis and Management*, 12(3) 1993, 532-555, Table 1, p. 537.

# Guardians vs Spenders

**TABLE 1-4** Coquihalla Highway from a Provincial Guardian's Perspective  
(1986 \$ Million)

	<i>No Tolls</i>	<i>With Tolls</i>
Revenues ("Benefits"):		
Toll revenues from British Columbia residents	0	112.1
Toll revenues from non-British Columbia residents	0	37.4
	<u>0</u>	<u>149.5</u>
Expenditures ("Costs"):		
Construction	338.1	338.1
Maintenance	7.6	7.6
Toll collection	—	8.4
Toll booth construction	—	0.3
	<u>345.7</u>	<u>354.4</u>
Net Revenue-Expenditure "Benefits"	345.7	204.9

**TABLE 1-5** Coquihalla Highway from a Provincial Spender's Perspective  
(1986 \$ Million)

	<i>No Tolls</i>	<i>With Tolls</i>
Constituency "Benefits":		
Project Costs (from CBA)	345.7	354.4
Project Benefits (from CBA)	<u>384.1</u>	<u>334.7</u>
	729.8	689.1
Constituency "Costs":		
Toll Revenues from British Columbia Residents	—	112.1
Net Constituency "Benefits"	729.8	577.0

# Steps in CBA: Coquihalla Highway

## 3. Identify the impact categories, catalogue them and select measurement indicators

- **Physical** Impact: inputs and outputs
- **Other** impacts: Health, Aesthetic, environment

1. **Perspective:** Opposite views on impact

2. **Specification:** Causal-and-Effect relationships

3. **Measurement:** Indicators and surrogates

## 4. Predict the impact quantitatively over the life of the project

- What would the impact be for each category in each time period?
  - Usually requires some estimation using existing information

Example: Lives saved – 2 reasons

- **Shorter:** New road is 130 vkm shorter  $\times 0.027$  lives lost per vkm = 3.5 lives/year
- **Safer:** New road is 313 vkm  $\times 0.027$  lives lost per vkm  $\times 0.33$  safety = 3.5 lives/year
- In total, 6.5 lives/year saved.

In practice, prediction is crucial but very difficult!

# Steps in CBA: Coquihalla Highway

## 5. Monetize (attach dollar values to) all impacts

- How much in dollar terms are the impacts?
- Estimates based on studies conducted prior to 1986
  - Opportunity costs
    - Leisure time saved per vehicle (25% of wages x average # of passengers) = \$6.68 per vehicle-hour
  - Willingness-to-pay
    - Value of lives saved = \$500,000 per life

## Alternative Approaches: Qualitative CBA, Cost-Effectiveness, and Multigoal Analysis

**Q-CBA:** Estimate order of magnitude

- E.g., Urban highway tree planting program

**CEA:** Quantification without monetization

- Ratios:  $n/c$ ;  $c/n$
- Targets: Maximum  $n$ , for given  $c$

**Multigoal:** Beyond efficiency

- Most general framework
- (1) relevant social values -> (2) general goals -> (3) policy alternatives

# Steps in CBA: Coquihalla Highway

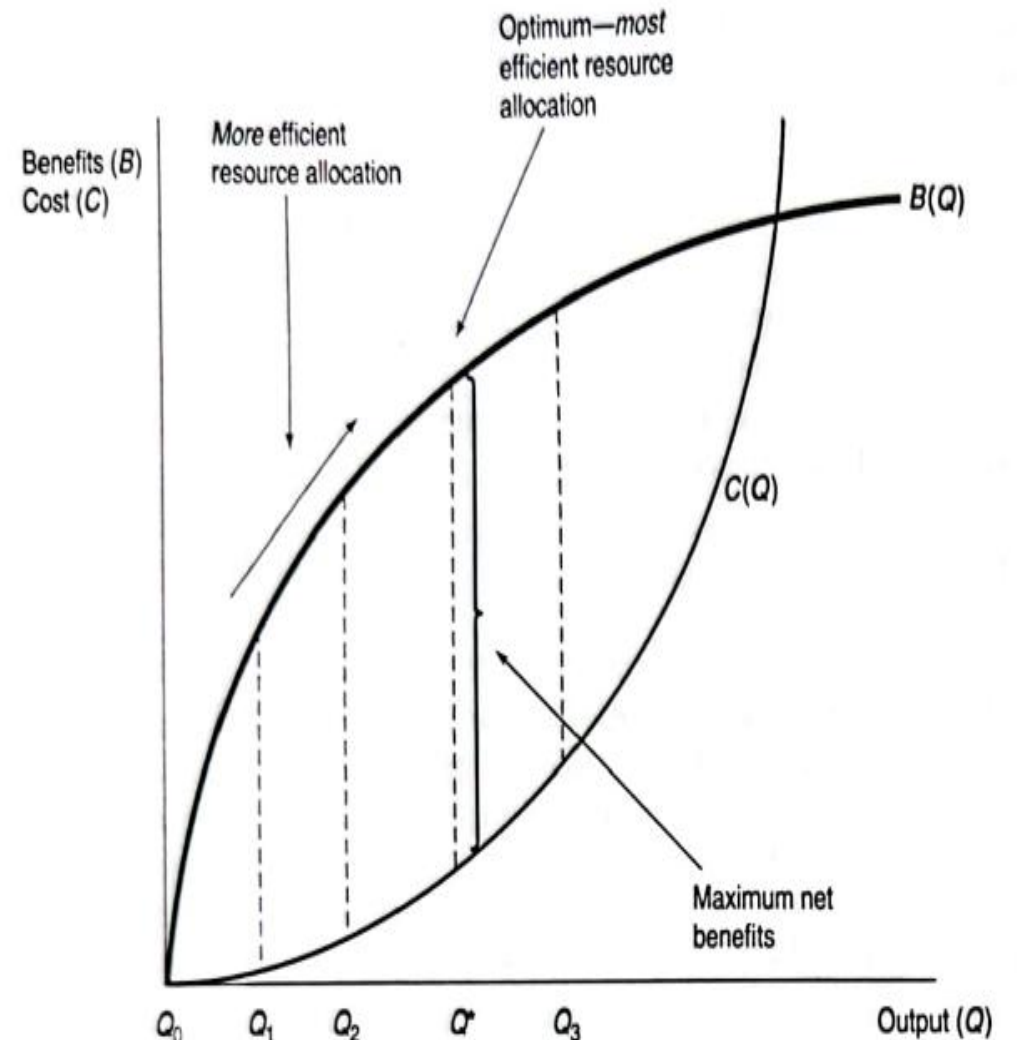
## 6. Discount benefits and costs to obtain present values

- What is the value, today, of all future impacts? - present values (PV)
  - Opportunity cost of waiting

$$\bullet \text{ PV}(B) = \sum_{t=0}^n \frac{B_t}{(1+s)^t}, \text{ PV}(C) = \sum_{t=0}^n \frac{C_t}{(1+s)^t}$$

## 7. Compute the net present value of each alternative

- $\text{NPV} = \text{PV}(B) - \text{PV}(C)$
- Decision rule: adopt a project if its NPV is positive
  - If there are more than one alternative, the select the project with the largest NPV
  - In the highway example, that highway without tolls has the greatest NPV
- Is this the *most* Efficient?
  - Conceivably there are other unexplored alternatives



# Steps in CBA: Coquihalla Highway

## 8. Perform sensitivity analysis

- Deals with uncertainty in impact prediction and monetisation
  - Number of lives saved; dollar value placed on statistical life saved
  - Social discount rate
- Practical limits – feasibility
  - Tractability of varying every assumption.
  - Focus on most important assumption

## 9. Make a recommendation

- What should be done?
  - Recommend (not decide) whether to proceed (or not)
  - Comparing all alternatives, suggesting the project with the greatest NPV
  - Without tolls > Status quo > With tolls
  - Caveat: Sensitivity analysis might shuffle the order

# Lessons from the Coquihalla Highway Project

- Tolls were part of the initial design for the Coquihalla, but a political decision removed them in 2008
- Analysis with tolls:
  - They also reduce demand for the new infrastructure
  - Tolls also reduce net benefits (*directly* due to the cost of collection and *indirectly* by reducing demand and usage)
  - Consequently, lower usage reduces all benefits since some users remain on the existing unsafe and untolled roads.
- Analysis without the tolls:
  - The costs are borne by taxpayers (most who are not users of the system) - illustrates the issues of “scope” and “standing”.
- Ultimately, anything that encourages users to stay with the old system, when their welfare could be increased by diverting to the new system, will reduce social welfare.



# Q & A

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- **References**

- Boardman, A., Greenberg, D., Vining, A., & Weimer, D. (2001). *Cost-benefit analysis: Concepts and practice*. Upper Saddle River, NJ (USA) Prentice Hall.
- Mason, G. (2024). Economic Evaluation of Public Policy [Lecture notes]. University of Manitoba.