Economic Evaluation of Public Sector Research—Can It Be Disaggregated?

(and implications for evaluation approach at project and program levels?)

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Conclusion:

- Can disaggregate for:
  - Non-interrelated projects
  - Groups of interrelated projects (which may or may not be programs)
  - All projects but only if one considers all probabilities of success and all combinations of projects
- Easier to disaggregate:
  - For retrospective assessments, because probabilities of success known

Assume two projects: a and b
B(1,1) = both successful; **B(1,0)** = **a** successful but not **b**; **B(0,1)** = **b** successful but not **a**

Linear projects	Serial projects	Parallel projects
B(1,1) = A + B	B(1,1) = B	B(1,1) = B
B(1,0) = A	B(1,0) = 0	B(1,0) = B
B(0,1) = B	B(0,1) = 0	B(0,1) = B
B(0,0) = 0	B(0,0) = 0	B(0,0) = 0

Subtract value for each B(1,0) and B(0,1) from the total benefit to get values for individual projects and add up. Gives correct group value in linear case, but an overestimate in serial and underestimate in parallel case.

Probabilistic Two Project Example

- Two projects each can succeed (1) or fail (0)
- Probabilities of success or failure of projects are independent.
  - Pa   Probability of success of project a
  - Pb   Probability of success of project b
- Benefits depend on combination of success and failure of individual projects (whether serial, parallel, non-interacting, or other)

Expected Value Analysis

Expected value of research program:

$$EV = P_a P_b\, B(1,1) + P_a(1-P_b)\, B(1,0)$$
$$+ (1-P_a)P_b\, B(0,1) + (1-P_a)(1-P_b)\, B(0,0)$$

For Linear: $EV = P_a A + P_b B$

For serial: $EV = P_a P_b B$

For parallel: $EV = (1-(1-P_a)(1-P_b)) B$

Can aggregate up to obtain correct value of total program, but must calculate all $B(\,,\,)$ terms. Cannot just assess one project at a time unless non-interacting.

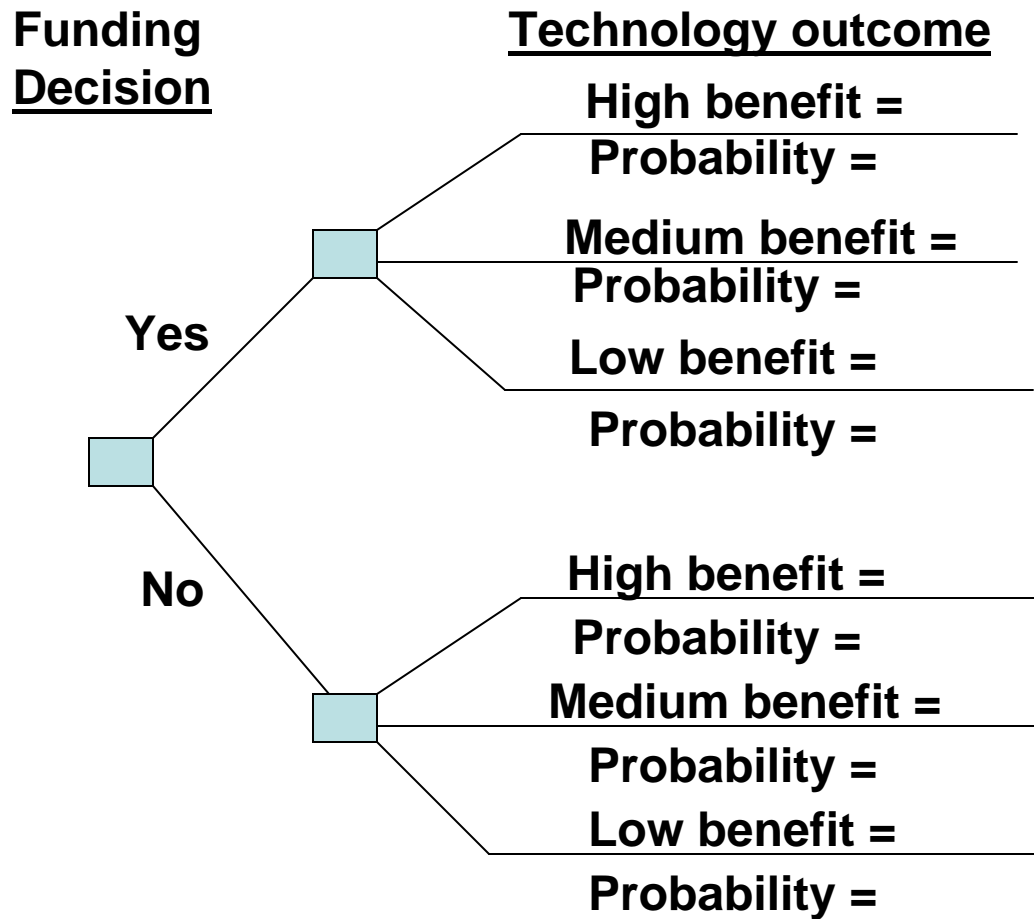# Possible Solutions for Prospective Evaluation

1. Combine projects into programs. Evaluate non-interacting programs

    or

2. Evaluate benefits of all combinations of success and failure, multiply by probabilities, add up over all combinations

    –   Allows project-specific disaggregating, but requires large number of assessments when several projects involved (would need to keep very simple)

Suggestion: Assess non-interacting projects or groups of interacting projects in prospective case:

	Global scenarios		
	High agr. prices	Medium Agr. prices	Low agr. prices
Probability of technical success			
Economic benefits			
Environmental benefits			
Security benefits			

(Source: Based on NRC, 2007)

Decision tree for a research project or program

Funding Decision

Technology outcome

High benefit =

Probability =

Medium benefit =

Probability =

Low benefit =

Probability =

Yes

No

High benefit =

Probability =

Medium benefit =

Probability =

Low benefit =

Probability =

(Source: Based on NRC, 2007)

When calculating benefits:

- Define research impact pathway (including linkages)
- Consider adoption rate
- Consider time lags
- Consider nature of market (size, trade, etc.)
- Assess non-market benefits
- For retrospective assessments, can select sample of projects