1.011 Project Evaluation
Dealing with Risks & Uncertainty

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1. Definitions
2. Techniques
3. Examples

Uncertainty

We cannot predict the future, and we may not even have good estimates of probabilities of possible outcomes.

- Variations about the norm
- Changes in trends
- “New Facts”
- Projects create new demands - and we can’t always refer to past experience

Risks

Risks refer to the possibility that something will go wrong. For example:

- Construction risks (unable to construct on time and within budget because of technical or organizational problems)
- Competitive risks (loss of market to better, earlier, or larger projects similar to or substituting for your project)
- Financial risks (changes in interest rates, exchange rates, credit limits that affect our ability to raise sufficient funds for project; changes in cash flows that affect ability to mortgage payment)
- Political risks (changes in government or in regulations that limit our ability to complete, open, or receive payment for our project)

Sensitivity Analysis

Systematic analysis of the effects of changes in one or more variable on our results and our choice of an alternative.

- Cost factors: unit costs, discount rates, process speed
- Benefit factors: prices, demand, external impacts

Key choices

- What is our base case?
  - Best estimate of all factors
- Which factors to vary? by how much?
  - Those with the greatest uncertainty and those related to known risks
  - Vary over likely range of options

Scenarios

A “scenario” is a set of internally consistent assumptions that together provide a vision of a “possible” future within which our project will be implemented.

- Broader than sensitivity analysis
- For example: Optimistic/Most Likely/Pessimistic

Elements of a Scenario - the factors that we believe are important to our project that we will vary across scenarios. For example:

- General economic conditions
- Response of competitors to our project
- Construction prices

"Make Uncertainty Explicit"

- Understand the uncertainties and the risks
  - Sensitivity analysis
  - Scenario analysis
- Seek protection against the most serious risk
- Use discount rates that are suitable for the risks evident for a particular project
  - Higher return for riskier projects
Protection Against Most Serious Risks
- Failure to meet budget & time table
  - Studies, site surveys
  - Penalty clauses in subcontracts
  - "Cost Plus" rather than "Fixed Price" contract
- Failure to meet revenue targets
  - Studies and surveys
  - Pricing & staging options
- Natural disaster; construction accidents
  - Insurance
  - Safety plan: WHEN to work; HOW to work
- Bankruptcy
  - Minimal leveraging; loan guarantees
- Government interference
  - Partnerships with government or local firms

Risks Are Shared Among the Actors Involved in a Project
- Are MY risks commensurate with MY potential benefits
- Can I include sufficient time in the work schedule to cover the expected range of delays and a sufficient amount in my budget to cover the expected range of cost variation?
- Can I get insurance to limit my liability for the worst things that might occur?
- Can I negotiate a better deal?

Bidding on a Project: Include a "Margin of Error"

Staging
- Break the project into several stages that can be implemented if and when demand warrants
  - May lead to higher construction costs for the project if all stages are eventually built
  - Added flexibility reduces risks that insufficient demand will lead to financial problems
- Examples
  - Build one tower where there is room for two
  - Buy options for additional land
  - Build a house, but don’t finish the basement or the attic

Probabilistic Risk Assessment
- Problem: how to deal with risks related to natural disasters or unusual events (earthquakes, fires, accidents)
- Assess risks
  - Probability of event (PROB)
  - Expected consequences of event (CON)
- Assess cost: C of reducing risks
- Compare incremental cost to incremental risk
  - If \( C < \text{PROB}(\text{new}) \cdot \text{CON}(\text{new}) \), then it is worth adding the extra cost.
  - There may be many effective ways of reducing risks

Public Role
- Loan guarantees
  - Reduce interest rates for private sector
- Partnerships
  - Ease burden of dealing with regulations
- Contract for services (e.g. for commuter rail)
  - Contractor provides service; agency absorbs risks related to demand and revenues
- Exclusive franchises (e.g. for highway)
  - Limit competition