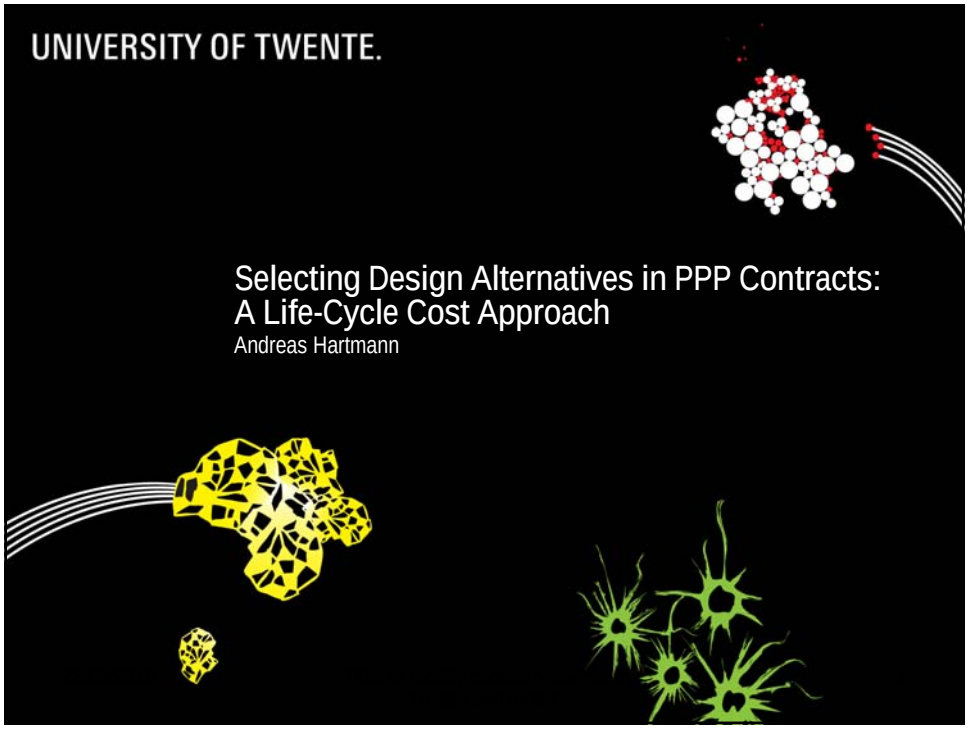


Background

- Infrastructure assets play critical role for the economic viability and social welfare of every nation
- Twin challenge of budgetary constraints and more value for money
- Successive involvement of private sector in service provision
- Integrated service packages covering large parts of or the entire life cycle of infrastructure assets
- Contracts describe performance requirements instead of prescribing detailed tasks

Challenge for PPP Contractors

- Greater optimization potential
- Flexibility in selecting design alternative that meets the required performance and has the lowest life-cycle costs
- Greater risks and uncertainties about long-term performance and cost development
- Trade-offs among the probabilities of performance and cost effects of different design alternatives

PPP Contracts - Characteristics

- Special purpose company (SPC) is being in charge of providing the infrastructure asset and associated services
- SPC is incentivized to seek for an optimal balance between the investment needed to meet the required performance, the financial return and the possible risks within the contract period
- Appropriate risk allocation between public and private sector
- Payment is often subject to the achievement of the performance specifications

PPP Contracts - Types of Requirements

Functional requirements	Describe what the infrastructure system (product and process) has to do
Performance requirements	Describe how the infrastructure system has to fulfill what it is expected to do Typical performance requirements include safety, maintenance, sustainability, reliability.
External requirements	Describe how the infrastructure system has to consider influences of the system environment
Internal requirements	Describe how the infrastructure system has to consider influences stemming from the interaction of subparts of the system

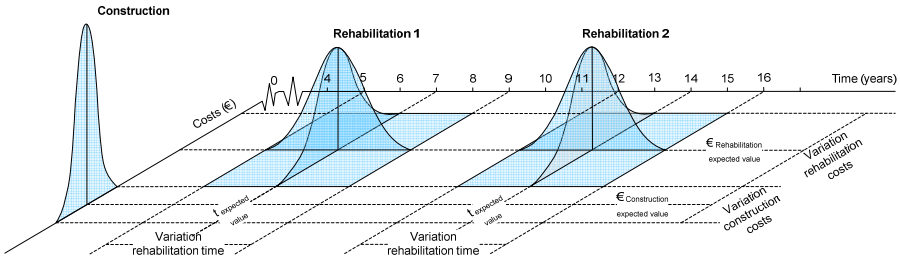
Life-Cycle Cost Analysis - Characteristics

- Decision-making tool for the trade-offs between different competing design alternatives of infrastructures
- Aim is to minimize the total cost of an infrastructure facility over its entire life-cycle without compromising the functional requirements
- Includes agency and user costs which are converted to a net present value by discounting them to a base year
- Should be conducted as early as possible in order to quantify the economic implications of initial investments

Life-Cycle Cost Analysis - Process

- Phases
  - Identification of design alternatives
  - Calculation of life-cycle costs
  - Analysis of results
- Time and costs of activities are always related to uncertainties in the technical, social, political and environmental context
- At most a probability distribution of both parameters can be provided

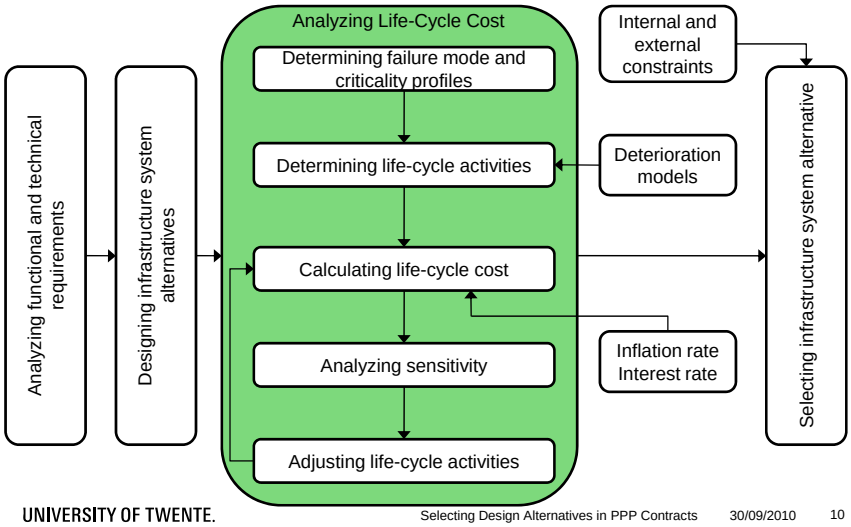
Time and Cost of Life-Cycle Activities



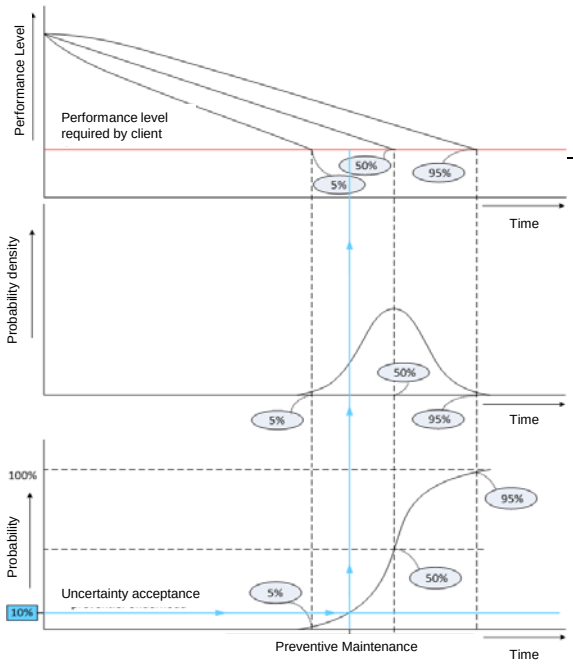
Decision-Making Process - Requirements

- Knowledge on the functional and technical requirements the client defined for the infrastructure facility.
- Criticality of subsystems and components in terms of generating extra costs due to missing performance targets.
- Planning and construction activities should be included in the life-cycle cost analysis.
- Identification of interventions that contribute to availability corrections or performance deductions
- Probability distributions of time, duration and costs of activities
- Decision on the acceptable level of uncertainty
- Comparison of the NPV of different design alternatives

Decision-Making Process - Activities



Decision uncertainty



Conclusion

- PPP contractors need to quantitatively analyze life-cycle costs of design alternatives in order to determine the financial consequences of contract penalties
- Optimization of the NPV of design alternatives through:
  - Deterioration models
  - Intervention activities
  - Uncertainty acceptance
- Sensitivity analysis reveals optimization factors with greatest impact
- Analysis of requirements is critical