Classes of Factors to be Considered in Infrastructure Investment Prioritization

By Bob Prieto

The prioritization of infrastructure investment must be focused on achieving the strategic objectives of the implementing agency or governmental unit while recognizing the broad role that infrastructure plays in serving society and supporting adjacent regional and national networks. Clear, robust objectives must be established; continuously articulated; alignment with affected stakeholders achieved; performance metrics established and continuously monitored and measured; and, corrective actions and portfolio adjustments made based on performance and changed futures. Many of these performance metrics will be associated with the factors to be considered in initial prioritization.

The strategic objectives established for our infrastructure systems must as a minimum address the following objectives:

- Economic – encompassing societal, agency (or governmental unit), and project considerations
    - Societal related economic considerations can include job creation; infrastructure efficiency; new opportunities created; level of quality of the system; contribution to directional desired change
    - Project level considerations focus more on the capital efficiency of the developed assets
- Social – including stakeholder related concerns and desires; contextual and cultural appropriateness; compatibility with community goals and other social objectives. It is important to recognize that stakeholders may include non-local interests such as seen from national level NGO’s, trade unions and business interests.
- Environmental – including both the environmental impacts associated with facility construction and operation but also the effects of longer term environmental factors including global climate change on our infrastructure facilities, systems and structures. Health, safety and security considerations may be considered in this context as well.
- Political – infrastructure is an important political and policy tool and outcome; equity (impact and benefit distribution)
- Sustaining Capacity and Capability – ensuring that public and user safety are sustained at acceptable levels and that operational and performance requirements are met throughout the life cycle by maintaining our infrastructure assets in a state of good repair. Emerging considerations around resilience as reflected in achievement of defined recovery timeframes represent new considerations for sustaining the capability and capacity of many infrastructure assets.

Successfully meeting today and tomorrow's infrastructure needs requires us to do not just more, but better. Our aspirational goal should be to reduce the life cycle cost of our new infrastructure systems and assets by 50%.

Objective, fact based prioritization of infrastructure investments represents a key first step in that process.

- Improving Outcomes – importantly, demonstrating continuous substantial improvement in life cycle cost to support capital efficiency and achievement of the broader set of objectives articulated; and addressing future resilience needs including those related to climate change and other man made and naturally occurring "events of scale"

The final developed set of objectives should be distilled to the smallest set of objectives considering common attributes. This becomes particularly relevant as we are prioritizing sustaining capital investments or selecting among fundamentally similar projects.

Prioritization Process

With final objectives defined, agreed to and clearly articulated, we can now set out on the process of defining how we will achieve those objectives and importantly how we will prioritize our decisions.

As shown in the following figure, we move through a four step process encompassing:

- Establishment of top level objectives, as described previously
- Development of a long term capital plan that encompasses a range of top level capital investment categories. This plan is an enterprise or portfolio level view and it is essential to allow more refined prioritization within the broader investment buckets likely to be defined.
- Prioritization, based on consideration of the classes of factors described in this paper, or their equivalent. This prioritization goes hand in hand with the development of the long term capital plan. A first pass at prioritization may include limited or no constraints beyond those inherent in the prioritization factors themselves.
- Constrained plan, placing financial or other constraints on the developed plan, narrowing the set of capital investments to be undertaken.

Categorization of enterprise or portfolio level investment categories will vary by infrastructure asset owner. Two potential categorizations include:

Investment Categories (#1):

- ***Maintenance***
- ***Productivity***
- ***Growth***
- ***Innovation***

Investment Categories (#2):

- ***Security/ Resilience***
- ***Discretionary***
- ***System Enhancements***
- ***State of Good Repair***

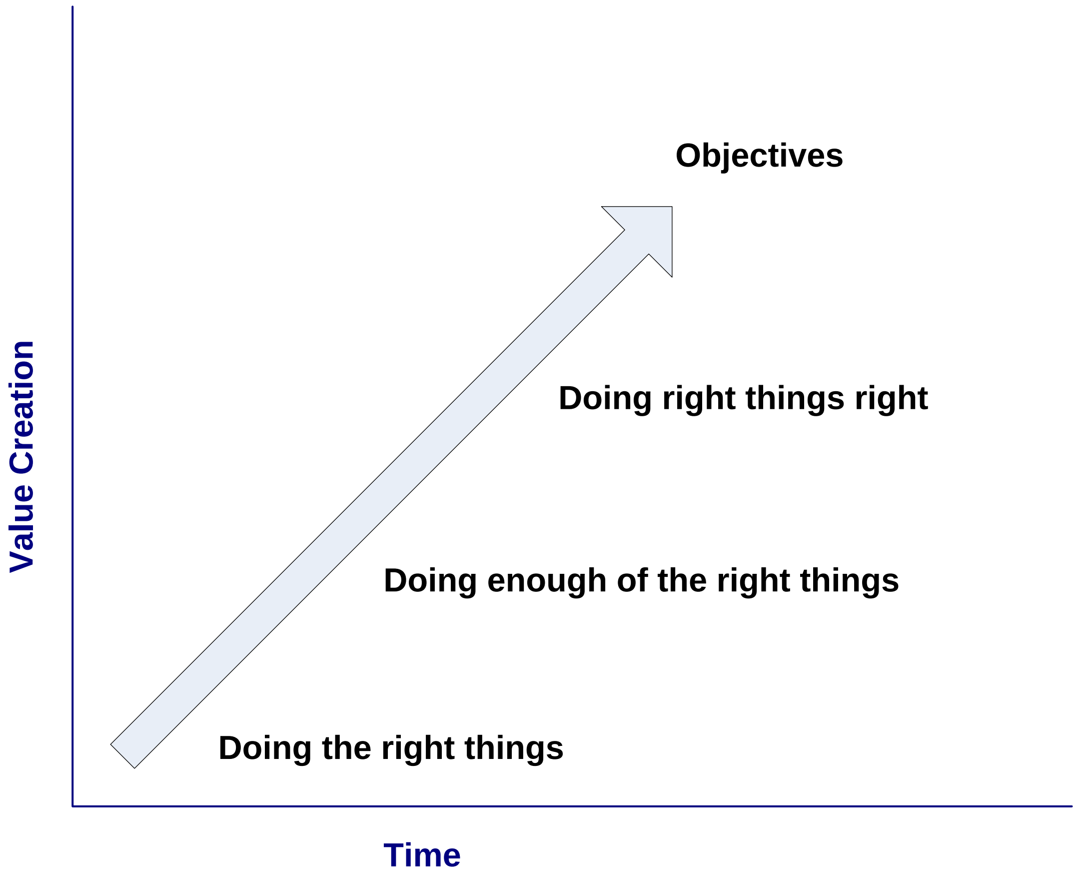
Classes of factors

It is clear from considering the scope of top level objectives to be considered when establishing infrastructure priorities that the number of potential factors that should be considered can be very large.
In order to more appropriately evaluate this large number of factors it is useful to create a structure of "classes of factors" that ensures our decision processes are thorough and appropriately balanced. This paper suggests one such structure and subsequently provides some guidance on categorizing the resultant projects selected and the types of metrics appropriate at both a "portfolio level" as well as at the individual project level.

The importance of a portfolio approach to prioritization cannot be overstated and even large scale programs must be understood to be part of this broader infrastructure asset portfolio.

The classes of factors to be considered in infrastructure prioritization must at the most fundamental level create value for the end users, local community and society more broadly. These factors must also ensure we are making adequate progress towards achieving our stated objectives and, importantly, doing so in a capital efficient manner. Specifically, the following categorization is suggested as a way to classify and consider the factors used in prioritization of infrastructure investments:

- Doing the right things
- Doing enough of the right things
- Doing right things right



Mapping Classes of Factors to Objectives

Utilizing this system of classification for factors important to infrastructure prioritization we can construct a matrix of objective-factor relationships to begin translating these considerations to more actionable levels that can define the data required to be available, collected, analyzed and deployed to create value. Any prioritization activity undertaken must be seen to create value and at a later stage this value creation must be realized and confirmed for the prioritization process to retain continued support and stakeholder buy-in.

Infrastructure Objective-Prioritization Factor Matrix			
	Classes of Infrastructure Factors		
Strategic Objective	**Doing the right things**	**Doing enough of the right things**	**Doing right things right**
Economic	• Economic opportunity creation • Prioritized plan	• Job creation rate • Robust portfolio and project management	• Quality improvement of infrastructure portfolio

	linked to achievement of objectives • Portfolio funding plan • Outcomes based projects that consider life cycle based costs, risks, uncertainties, financing strategies • PPP policy and framework in place	capabilities	• Efficiency improvement of infrastructure system
Social	• Infrastructure system is contextually and culturally aligned with societal needs • Infrastructure is compatible with community goals and other social objectives • Broad awareness of current and emerging infrastructure needs and risks • Engagement of disadvantaged and local businesses in project development • Defined sustainability framework	• User support of selected infrastructure projects • User support of portfolio funding plan • Construction mitigation strategies reduce societal impact during construction	• Level and extent of stakeholder support • Stakeholder acceptance of the selected infrastructure projects • Stakeholder acceptance of the changing infrastructure portfolio

Environmental	• Conformance with all applicable regulations • Environmental mitigation during construction • Defined sustainability framework	• Enhanced environmental quality as a result of implementation of selected projects	• Reducing contributions to global climate change and other environmental challenges
Political	• Effective public engagement programs • Supportive regulatory framework in place • Owner readiness • Equitable impact and benefit distribution	• Bi-partisan support for funding plan	• Full process transparency
Sustaining Capacity and Capability	• Effective preventative maintenance program • Infrastructure sustainment from a performance and quality standpoint • Asset management plan in place	• Predictive maintenance program • Sustaining capital program including infrastructure productivity improvement • Improved resilience of critical infrastructure to the effects of climate change • Improved resilience of critical infrastructure to other natural and man-made events	• Overall capital efficiency improved • Community resilience

		of scale • Resilience code	
Improving Outcomes	• Life cycle cost based project prioritization and implementation • Accepted prioritization plan • Strengthened resilience focus on a project and portfolio basis • Performance based contracting utilizing life cycle performance standards	• Continuous reduction in life cycle cost and progress towards a 50% reduction in life cycle cost by 2025 • Reduced exposure and materialization of risks of all types	• Overall capital efficiency improved

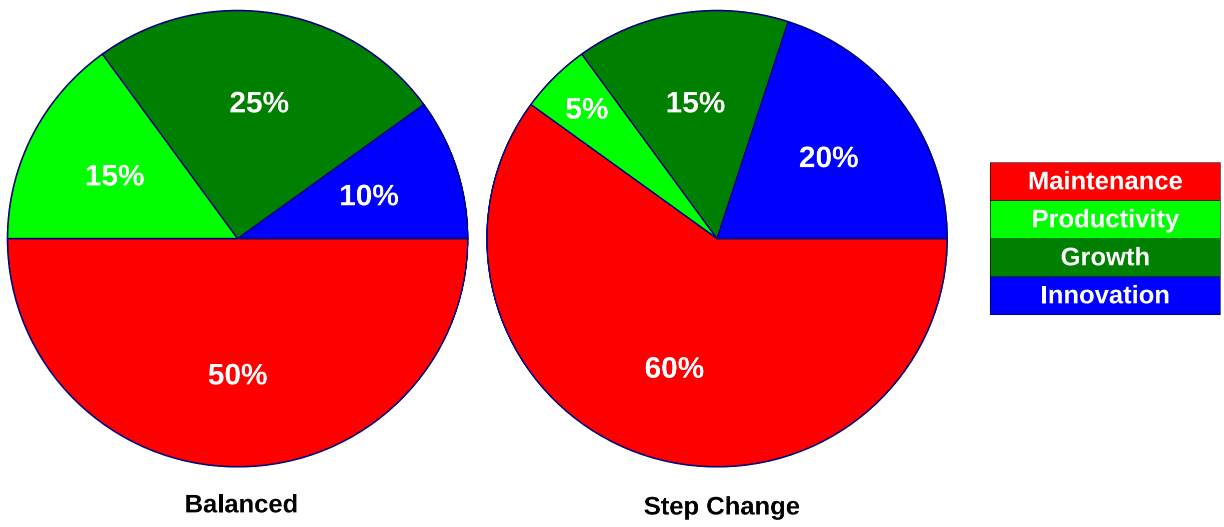
The above matrix provides a starting point for ensuring that our investment priorities support not only the proper selection among hard choices but also that we are undertaking these activities at a rate that will actually move us forward in the direction we want at an acceptable rate. Key to achievement of our objectives is the need to continuously improve not only what we do but how we do it. We must do the right things right…and in an improving way. Appendices 1 through 6 further detail some of the individual elements in the developed matrix and are intended to be illustrative.

Each of the candidate projects we undertake must contribute towards advancing us towards one or more of our objectives. They must be the right projects, done at the right rate and in the right way. It is helpful from a portfolio perspective to be able to categorize the candidate and ultimately selected projects to ensure that we are appropriately balancing our efforts across all classes of prioritization factors. A useful categorization of projects segregates them into four categories:

- Maintenance
- Productivity
- Growth
- Innovation

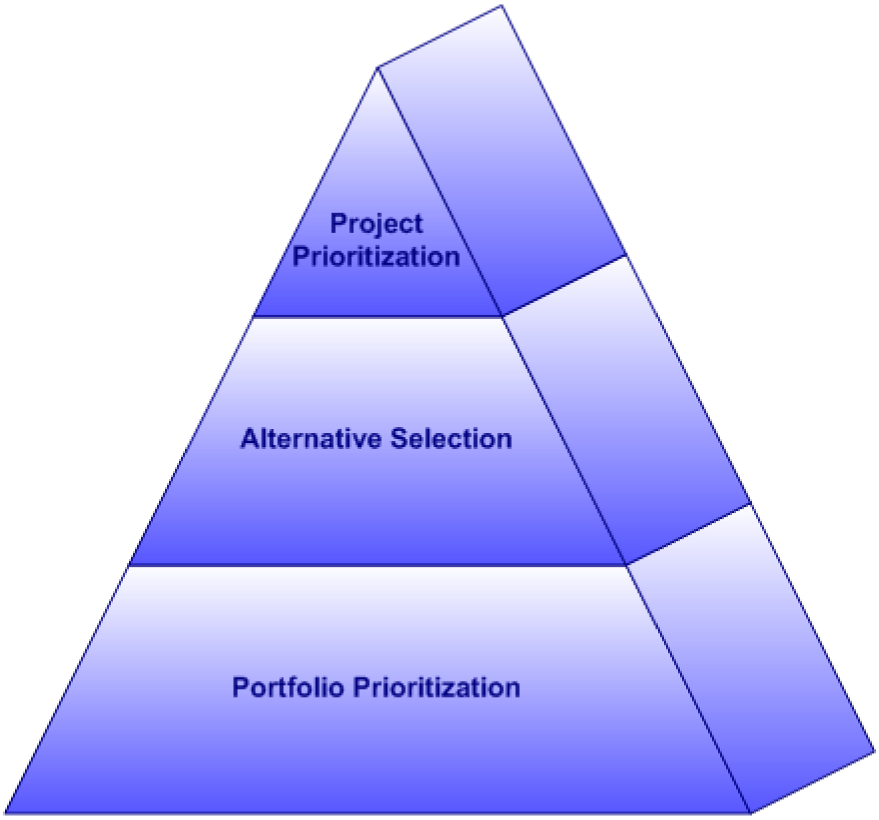
Depending on our defined objectives we may select very different balanced portfolios as illustrated in the following figure. The first portfolio exhibits a focus on sustaining existing infrastructure and enhancing its productivity (50% +15% = 65%) while the second places similar aggregate emphasis (65%) on these two factors but seeks to improve the state of good repair with a much more limited focus on productivity enhancement (60% + 5% = 65%). While both portfolios seek to grow and improve outcomes through innovation, the second portfolio limits resources applied to growth projects in favor of step change improvement through innovation.

Alternative Portfolios of Projects Reflect Defined Objectives and Strategy



Projects are prioritized based on considerations shown in the prior table, and the assembled portfolio tested for the desired strategic portfolio balance that is desired.

Within a given portfolio element, more refined prioritization can be used to establish alternatives to be considered and adopted or sequencing of a series of similar projects. For example, maintenance projects focused on supporting a state of good repair may be prioritized based on criticality to maintaining asset safety or functionality and performance levels. In effect this refined prioritization is just a narrowing of overall prioritization factors among similar asset or investment types.



This approach provides for strategy driven weighting of project mix and acts to ensure that singular objectives that are heavily weighted do not create an unbalanced infrastructure investment portfolio. The balanced portfolio may be tested for contributions to the various strategic objectives established and individual project scopes further rationalized to achieve the right balance and contributions to the various outcomes desired. Scope rationalization and a fact based basis for scope control are direct benefits of a strong factor based prioritization process for infrastructure investment. Portfolio level metrics may be cascaded down into individual projects to further assist in rationalization of infrastructure investments. The requirements of a good prioritization methodology are discussed in more detail in the following section.

Requirements of a Good Prioritizing Methodology

There are many requirements that a good prioritizing infrastructure investment methodology must satisfy. We have already seen some:

- Establishment of specific, measurable strategic objectives that our infrastructure investments are intended to move us towards. A focus on common attributes helps make this a manageable task.
- Categorization of the various prioritizing factors into three broad classes:
  - Doing the right things

Prioritization of our infrastructure investments is critical in a financially constrained environment. We must maximize capital efficiency by ensuring that we are:

- Doing the right things

- Doing enough of the right things

- Doing right things right

- Doing enough of the right things
- Doing right things right

- Mapping of these broad classes to the various strategic objectives to create a set of more explicit and actionable set of factors to be considered with further development illustrated in Appendices 1-6.

Each of these considerations contributes to a strong prioritization foundation upon which a strong prioritizing methodology may be further built. This methodology must encompass:

- Consideration of relative value and risk associated with various infrastructure investments including thresholds and constraints
- Careful benefit tracking to ensure economic, environmental and social benefits are tangible and not double counted
- Feedback loops that ensure that the various assumptions made at the project prioritization stage are realized and that further assumption bases for subsequent prioritization efforts are informed by the actual results obtained. Our three broad classes of factors we consider are thus informed by answering the question, "Are we getting the results we desire?"
- Economic and financial models that support differentiation, prioritization and optimization of infrastructure investments
- Cash flow requirements and concomitant funding and revenue modeling
- Clear guidance on the components of capital efficiency to be included in the prioritization effort and the temporal limits of any analysis
- Multi-factor analysis or a composite scoring system with well thought out weighting.

The developed prioritization methodology provides a framework for identifying metrics to be tracked, changes to be monitored and ongoing impacts to the balanced portfolio.

One of the challenges in any prioritization methodology is to recognize that the various prioritization factors may effectively be in different "currencies". How do you prioritize infrastructure investments considering economic returns ($), reduction in greenhouse gasses (tons of CO_2 equivalent) and jobs created?

One strategy for comprehensively assessing these impacts is to assign a monetary conversion factor or an “exchange rate” to environmental and social benefits and impacts. While greatly simplifying the analysis involved, it may be highly distortional, leading to a recommended infrastructure investment portfolio strategy that is either environmentally or socially unacceptable.

From time to time, such summing may occur, in effect placing value on a day lost to illness, a life, or the totality of impacts from a ton of carbon. In such instances, it is essential that the respective “currency” values not be lost and that appropriate sensitivity analysis be performed to confirm that the selected “currency conversion” values are not distortional. We must remember that weighting involves value choices.

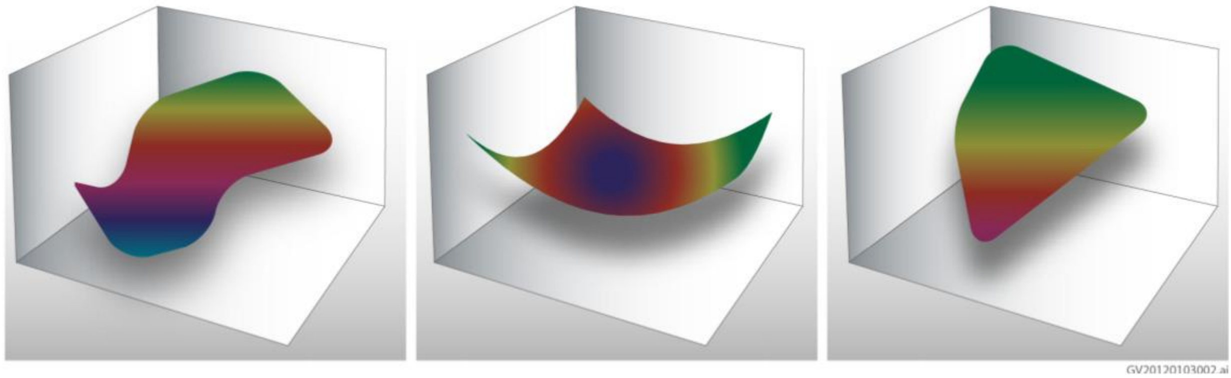
An alternative approach would be to seek to optimize within a framework consisting of “multiple currencies,” utilizing a “multi-currency” or multi-objective optimization strategy. These strategies may also be referred to as:

- Multi-objective programming
- Vector optimization
- Multi-criteria optimization
- Multi-attribute optimization
- Pareto optimization

These strategies are used where tradeoffs may encompass two or more conflicting objectives. This may often be the case as we undertake a multi-stakeholder infrastructure investment prioritization effort.

Let’s consider a prioritization effort involving only three currencies – economic, environmental and social. It is readily apparent that various environmental factors such as acres of green space lost and/or temperature rise in a local steam may not be readily summable, and the extension of this approach to consider a larger number of currencies is possible.

Solutions to this three-currency optimization problem will fall within a set of Pareto optimal solutions which can then be subject to further analysis through the introduction of additional constraints or preferences. A solution is called a non-dominated, Pareto optimal solution (also sometimes referred to as Pareto efficient or non-inferior) if none of the “currency” values can be improved without impairment of other values. The set of Pareto optimal outcomes is called the Pareto front.



In a multi-objective optimization problem, we seek to minimize each of the "currencies." In the case of a "currency" we seek to maximize, such as a benefit created, the minimization would be of its negative value. A key task is in identifying a sufficient number of constraints to adequately bound the optimization effort.

Other prioritization methodologies are possible but must adequately consider the common attributes linked to our established strategic objectives; encompass all three classes of prioritization factors identified; and address any subjective bias inherent in dealing with "multi-currency" optimization as just described.

Conclusion

A framework for developing infrastructure investment objectives is suggested. A top level ontology of "classes of factors" recommended and a matrix of first level factors defined by considering this objective- class of factor prioritization space. The appendices further develop some of these first level factors and the intent is not to suggest that all be considered but rather represents an initial starting point for evaluating which small set of factors is most appropriate for use in prioritizing infrastructure investments. Finally, additional considerations that a strong prioritizing methodology must address are suggested and the challenges of "multi-currency" prioritization highlighted.

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Appendix 1

Factors Related To
Continuous Reduction in Life Cycle Cost and Progress towards A 50% Reduction in Life Cycle Cost By 2025

- Revenue
  - First Revenue Date
  - Plant Availability Factor and Ramp-Up Period and Rate
  - Asset Life (Duration from First Revenue during analysis period)
  - Scheduled Shutdowns (Regulatory, Seasonal, Maintenance)
  - Supply/Demand Balance Normalized Price(Market Size; Competitor Actions)
  - Capacity or Throughput
  - Byproduct Value Captured
  - Tax Credits Realized
  - Inflation Adjustments to Normalized Pricing (Inflation; Currency Exchange Rates)
- Indirect Asset Costs
  - Land use
    - Land use impacts include:
      - Land use (the plant site)
        - Emissions to air
        - Emissions to water
        - Emissions to soils.
      - Land use change
        - Mineral and fossil fuel use
        - Land transformation
        - Land occupation
        - Soil erosion, compaction and sealing
      - Often ignored in LCA but taking on increasing importance.
    - ISO 14040 – 14043, largely developed from industrial perspective and do not mention land use as an impact category
    - Land use considers following factors:
      - Concurrent availability –site is available on some basis for use by other facilities. Important when evaluating large program or asset portfolio design. May be either:
        - Constrained or limited
        - Unconstrained or unlimited (except with respect to limiting attributes of the site independent of the facility's presence at the site)
      - Concurrent unavailability – the site is not available for other current use due to the facility's presence at the site.

- Loss of optionality – site use, post facility closure, is limited because of the prior presence of the facility
- Permanent unavailability – use of the site, post closure, is not reasonably possible

- Tax Regime
  - Taxable
  - Tax Credit
  - Tax Exempt
- Financing structures
  - Common factors
  - Financial factors – hyper inflation, deflation, uninsured portion of disasters (natural, manmade, or Natech)
  - Environmental factors – climate change
  - Social factors – change in user behavior, change in surrounding community behavior with respect to the facility; compatibility with community goals and other social objectives
  - Correlated risks
  - Financing structures considered in a life cycle analysis influenced by many factors including:
    - asset characterization
    - governing financial metrics (ROE, ROI, IRR, ROA)
    - asset lifetimes before refurbishment or replacement
    - refinance periods
    - construction and operations cash flows
    - residual value of asset

- Externalities
  - Intangibles such as brand value
  - Complexity
  - Assumption migration associated with longer time frames (***dynamic risks***)
  - Stakeholder trust
  - Susceptibility to “Black Swan” type risks
  - “Strategic speed”
  - Regulatory taxes and subsidies
  - Potential “Black Swan” factors to be considered in life cycle analysis include:
    - Financial factors – hyper inflation, deflation, uninsured portion of disasters (natural, manmade, or Natech)
    - Environmental factors – climate change
    - Social factors – change in user behavior, change in surrounding community behavior with respect to the facility
    - Correlated risks
- Planning and Permitting

- Impact of Permitting on Life Cycle Analysis:
    - Reduced revenue
    - Higher risk weighted cost of capital –investors may seek higher returns as they wait patiently and with a higher degree of uncertainty for the facility to obtain necessary approvals. Similarly debt costs may be higher especially in instances where project funding is utilized.
    - Higher permitting costs
    - Higher environmental mitigation or enhancement costs
    - Increased project escalation costs

- Design
  - Factors Typically Considered in a Capital Asset Life Cycle Analysis
    - Labor Costs -professional services
    - Benefits from standardization /design reuse
    - Premium costs incurred because of schedule
    - Cost of Time (design duration/phasing)
    - Value of Risk (technology or other first of a kind risks; labor availability risk)
    - Design estimate uncertainties (estimating based; management model driven; rework based on late inputs or owner driven changes)
    - Consideration given to procurement and supply chain strategies (relates to potential for design rework or impacts on procurement)
    - Degree constructability considerations have been incorporated into design activities (influences design and construction management costs with the prospect of reduced construction durations and costs)
    - Life cycle and sustainability focus and provision in cost and schedule for more aggressive engagement of O&M managers, staff and key suppliers
- Procurement & Construction
- Operations
- Maintenance
  - Reliability
  - Availability
  - Capacity Factor

Appendix 2

Factors Related to PPP Policy

- Policy framework (this is essential in any regulatory framework selected)
- Toll rate level and structure
- Concession payments (or government subsidy or facilities or services in kind)
- Penalties and fines for non compliance
- Concession period and its linkage to rate of return
- Timing of investment and reinvestment obligations
- Quality of service obligations
- Investment level obligations
- Depreciation and amortization rules (tax and accounting policy issues)
- Forms and timing of restructurings allowed
- Nature and duration of any exclusivity or restrictions on competing facilities
- "Social" composition of user base (unintended social consequences)
- Idiosyncrasies / uncertainty in forecasting models
- Policy/rights retained and related to sequestration, forfeiture, withholding or suspension of guarantees, liability allocation and third party liability

Appendix 3

Factors Related to A Defined Sustainability Framework

- Major elements of sustainability are a fundamental requirement
- Focus goes beyond first cost to a comprehensive life cycle perspective
- Set of balanced solutions exist.
- Management and execution approach based on systems approach
- Sustainability framework at all program and project phases
- Procurement of local goods
  - Local construction materials & tools adds income in immediate area & contributes to local tax base through sales tax
- Creation of a local service base to support the facility during operations and maintenance phases.
- Anti-corruption measures
- Tied closely with social opportunities and benefits
- Social metrics considered

Social Metrics	
Diversity	• Existence of equal opportunity policies or programs
	• Percentage of senior executives who are women
	• Percentage of staff who are members of visible minorities
	• Percentage of staff with disabilities
Industrial Relations	• Percentage of employees represented by independent trade union organizations or other bona fide employee representatives
	• Percentage of employees covered by collective bargaining agreements
	• Number of grievances from employees.
Child Labor	• Whether contractors are screened (or percentage screened) for use of child labor.
Community	• Earnings donated to the community;
	• Use of local contractors and suppliers.
	• Involvement in projects with value to the greater community

Appendix 4

Factors Related to Owner Readiness

- Program demand related forecasts
- Factors related to program revenues
- Equitable impact and benefit distribution
- Owner's financial condition
- Resources available to the program
- Competing programs and associated resource requirements and timing
- Assumed changes to law, regulation or policy impacting owner and program and anticipated timing
- External environment
- Operating strategy and required lifecycle performance
- Owner's risk posture and philosophy
- Business model, scenarios and relationship to program
- Prerequisites for external approvals
- External approval requirements, timing and likelihood
- Prerequisites for owner's executive approvals and linkage to a formal stage gate process including clarity and comprehensiveness of stage gate requirements and processes; stage gate approvals, authorities granted, resource commitments and constraints; approvals matrix
- External prerequisites linked to stage gates including regulatory approvals required, process clarity and timing including safety case requirements; and process for property acquisition
- The owner's organization must also demonstrate readiness to:
    - Implement the stage gate process, consistent with the owner's own requirements and consistent with a program's demands. Approval time frames, gate expectations and nature of obtained approvals at each gate must tie clearly into program execution strategies.
    - Support management of demand for capital
    - Drive capital efficiency in projects as they advance trough the stage gate process. Among various elements of owner readiness to be considered would be the early focus on construction realities, constraints and opportunities that may be found in appropriate means and methods selection.
    - Enhance project execution by providing a disciplined project development framework
    - Enforce standards on management evaluation of alternatives including consideration of life cycle cost and performance evaluations. Significant life cycle performance benefits can accrue from strong incorporation of O&M considerations in the earliest stages of a program but many

programs suffer from later stage changes because of lack of an early focus in this regard.
    - Influence acceptable risk frameworks commensurate with investments being undertaken and the risks program will face
    - Provide independent validation and verification
- Capability of owner's technology platforms to support the program are established and functioning at a level consistent with the program's needs
- Physical and cyber security requirements of owner and external organizations with requisite authorities are consistent with the program's risk profile and the sensitivity of data and communications involved
- Required reports by owner on program progress can be efficiently provided to external stakeholders and that there is a plan to do so.
- Internal audit structure and controls are in place and associated budgeting and staffing requirements are recognized
- Inspector general role, authorities and resources are clearly defined with respect to program role and a plan exists to mobilize these resources in support of the program

Appendix 5

Factors Related to Asset Management Plans

- A cradle to grave life-cycle approach.
- Developing and implementing cost-effective strategies recognizing the long-term purpose and nature of these assets
- Defining, establishing and providing for a defined nature and level of service
- Monitoring, maintaining and where possible enhancing asset performance.
- Anticipating, mitigating and managing risks associated with asset degradation and failures
- Implementing asset management to achieve these objectives on a financial, environmental and societal basis.
- Sustaining and where possible enhancing system level characteristics of an asset such as resiliency, flexibility and future optionality.
- Deploying the limited financial, physical and human resources of the asset owner in an efficient, effective and sustainable manner. It is about making informed tradeoffs as part of our decision making process.
- Continuously improving asset management practices.
- Define the minimum level of detail for an asset (what assets to track)
- Establish a uniform asset enumeration scheme (asset organization)
- Identify existing assets and related attributes (asset data)
- Identify the probability and consequence of failure of an asset (asset risk)
- Establish the level of asset management performed (asset management strategy)
- Establish short-interval portions of asset plans
- Establish long-interval portions of asset plans
- Develop procedures to update asset plans
- Asset Development including achieving these objectives:
  - Develop a systematic approach to creating assets
  - Consider constructability, maintainability, and operability in the design process
  - Require that enumeration schemes be followed by designers and contractors
  - Maximize contractor contribution to asset development
  - Prepare asset plans coincident with asset delivery
- Asset Operations and Maintenance
  - Defining required preventative maintenance activities.
  - Preventative maintenance scheduling
  - Performing defined preventative maintenance activities at the prescribed intervals.
  - Using indirect condition assessment where cost-effective.
  - Performing corrective maintenance on a timely basis.
  - Management of maintenance using a balanced approach between preventative and corrective maintenance
  - Recording maintenance costs on an activity basis, by asset.
  - Management of operational methods to minimize the combined costs of O&M.

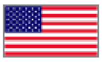
  - Key objectives of asset O&M:
    - Proactive safety management
    - Track asset failures consistently
    - Prioritize work order backlog by risk
- Asset Condition Monitoring has 3 goals:
  - Define condition monitoring methods
  - Define condition monitoring program
  - Integrate condition monitoring with other management and work processes

Appendix 6

Factors Related to
Reduced Exposure and Materialization of Risks of All Types

- Labor Availability & Cost
- Labor Productivity
- Labor Impacts on Program Location
- Material Availability & Cost
- Long Lead Equipment
- Construction Equipment
- Logistical Costs
- Life Cycle Costs
- Relocation or Reconfiguration Costs
- Industry Creation
- Balance Sheet
- Risk & Insurance Costs
- Procurement and contractual frameworks
- Craft capacity building
- Management capacity building
- Global leading best practices
- Societal supporting facilities
- Managing uncontrollable growth
- Performance management
- Waste streams
- Energy
- Water
- Recyclable/reusable materials

About the Author



Bob Prieto
Senior Vice President
Fluor

Princeton, NJ, USA

Bob Prieto is a senior vice president of Fluor, one of the largest, publicly traded engineering and construction companies in the world. He focuses on the development and delivery of large, complex projects worldwide. Bob consults with owners of large engineering & construction capital construction programs across all market sectors in the development of programmatic delivery strategies encompassing planning, engineering, procurement, construction and financing. He is author of "Strategic Program Management", "The Giga Factor: Program Management in the Engineering and Construction Industry" and "Application of Life Cycle Analysis in the Capital Assets Industry" published by the Construction Management Association of America (CMAA) and "Topics in Strategic Program Management" as well as over 500 other papers and presentations.

Bob is a member of the ASCE Industry Leaders Council, National Academy of Construction and a Fellow of the Construction Management Association of America. Bob served until 2006 as one of three U.S. presidential appointees to the Asia Pacific Economic Cooperation (APEC) Business Advisory Council (ABAC), working with U.S. and Asia-Pacific business leaders to shape the framework for trade and economic growth and had previously served as both as Chairman of the Engineering and Construction Governors of the World Economic Forum and co-chair of the infrastructure task force formed after September 11th by the New York City Chamber of Commerce. Previously, he served as Chairman at Parsons Brinckerhoff (PB), one of the world's leading engineering companies. Bob Prieto can be contacted at Bob.Prieto@fluor.com.