Environment issues: Infrastructure projects

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Infrastructure Projects-- need

- Demands for investment in infrastructure come from
  - need to maintain, modernise, or replace existing infrastructure
  - additional infrastructure to support new ways of working and living for an increasing population.
- Comprises a broad range of activities
  - Roads, railways, dams, ports, transportation alternatives, energy production , flyovers,
- Catalyst for economic growth
- Meeting needs of increasing population and urbanization

Infrastructure development

- New infrastructure development brings significant environmental, economic and social benefits
  - including the opportunity to build in such a way as to meet the challenges posed by climate change
- Can also have significant costs on the environment in construction, use, decommissioning or disposal
  - impacts can be local or across a much wider area and the infrastructure
  - investment may not always benefit the people who experience the impacts

Environmental impacts

- Impacts on
  - Land
  - Ecology
  - Water resources and water environment
  - Materials
  - Energy, greenhouse gases and other emissions to air
  - Human environment

Impacts on land

- New infrastructure typically involves land use change, selection of the site
- Land use impacts affected by whether the land is:
  - of special consideration to the local community and indigenous population
  - on or near an area(s) of architectural significance
  - on land that is part of a nature conservation area, national park or other protected landscape
  - a site of particular cultural or scientific interest
  - in a forest (issue around deforestation)
  - on a floodplain (resilience to flood risk)
  - agricultural land

Impacts on land

- Adverse impacts
  - Removal of trees
    - can reduce sustainability and ability to act as a “sink” for carbon dioxide emissions -- reduce their impact on global warming
    - Can remove natural barriers to wind and weather which can add to soil erosion and impacts on other ecology
  - Land erosion, compacting due to use of vehicles/heavy machinery
  - Soil contamination with toxic materials
  - Reduce capacity of the land to absorb rainwater, increase run-off, reducing the land’s ability to store water, act as a flood plain and can impact on river flows and the sediment cycle.
  - Pollution and wastes contaminate land, with heavy metals and organic pollutants transported from the site by wind or water and toxic materials potentially accumulating and contaminating land/water

Impacts on land

- Positive impacts
  - Opportunity to investigate the archaeology of the site and the removal, restoration and conservation of items found
  - Land selected may have previously been contaminated and the infrastructure development can offer an opportunity to regenerate and reuse it

Impacts on ecology

- Adverse impacts
  - Change in land-use destroy existing habitats /species
  - Degradation during construction,/operation through noise, vibration and light pollution or waste may also disturb habitats / wildlife and can affect plant and fruit growth
  - May hinder the movement of animals through habitat destruction or fragmentation, impact on species population dynamics
  - Reduce the ability of the natural environment, its habitats and species to adapt to climate change
  - Put pressure on nearby ecologies also

Impacts on ecology

- Positive impacts
  - present opportunities on the site to extend, improve or create new habitats for existing wildlife and plants
  - Restoration/enhancement of surrounding features unaffected by development or creation of new/ additional buffer areas to reduce impacts

Impacts on water resources/water environment

- Adverse impacts
  - may add to increased demand for water, so add to pressure on water supplies in the local area
  - contamination/pollution of on-site ground/surface water altering its acidity, pH balance, salinity and impacting on aquatic plants, fish and animals through
    - Leaks and spills from tanks, pipes, vehicles
    - Accidents/spillage during storage /transport of raw materials, manufactured products and waste materials
    - Storage of waste arising from the construction/operation of the infrastructure on or adjacent to the site
    - Leaching of pollutants from the materials used in construction

Impacts on water resources/water environment

- Discharge of poor quality water after use in technological processes during construction- Fly ash contaminating groundwater, for example from combustion of solid fuel such as wood, peat, coal in power stations.

– Site may be vulnerable to flooding/change the flood risk to those downstream or adjacent to it

- Positive impacts
  - Chance to minimise consumption of water through
    - collection and utilisation of rainwater during construction and operation
    - installation of water efficient equipment;
    - the re-use of grey water on site

Impacts on Materials

- Adverse impacts
  - Materials such as coal can be from unsustainable sources, damage environment, create pollution during their extraction
  - Many materials used are produced in an energy intensive process like cement production for concrete releases about 5 % of global CO^2 emissions and steel accounts for 4 to 5 %
  - Some materials used in construction treated with chemicals which can result in toxic emissions such as polycyclic aromatic hydrocarbons, which cause air pollution/health hazards

Impacts on materials

- Positive impacts
  - Designs for new infrastructure can minimize the use of materials with higher environmental impact and use instead sustainable products, such as sustainably sourced wood instead of concrete
  - Opportunity during construction to source materials that are re-used or recycled reducing waste from other sites that would otherwise need disposal

Impacts on energy, greenhouse gas emissions and other emissions to air

- Adverse impacts
  - Transportation to and from sites results in emissions to air of carbon dioxide, carbon monoxide, nitrous oxides (NOx), sulphur oxides (SOx), dust, polyaromatic hydrocarbons (PAHs) and particulate matter (PM)
    - contribute to climate change and have impacts on air quality which can result in both health and environmental impacts
  - Energy used in construction of infrastructure from consumption of fossil fuels contributes to greenhouse gas emissions and other polluting emissions
  - Energy infrastructure, such as heating and electricity energy systems, can be inefficient with a lot of energy being lost along the way as it moves from the source to the end-user

Impacts on energy, greenhouse gas emissions and other emissions to air

- Positive impacts
  - Infrastructure itself can be part of the transformation to a lower carbon economy, for example if it is new energy infrastructure or rail transport to take freight off roads
  - Infrastructure design may incorporate energy-saving or energy generating features and can make them more efficient
  - The design can include technology to reduce emissions and carbon capture and storage

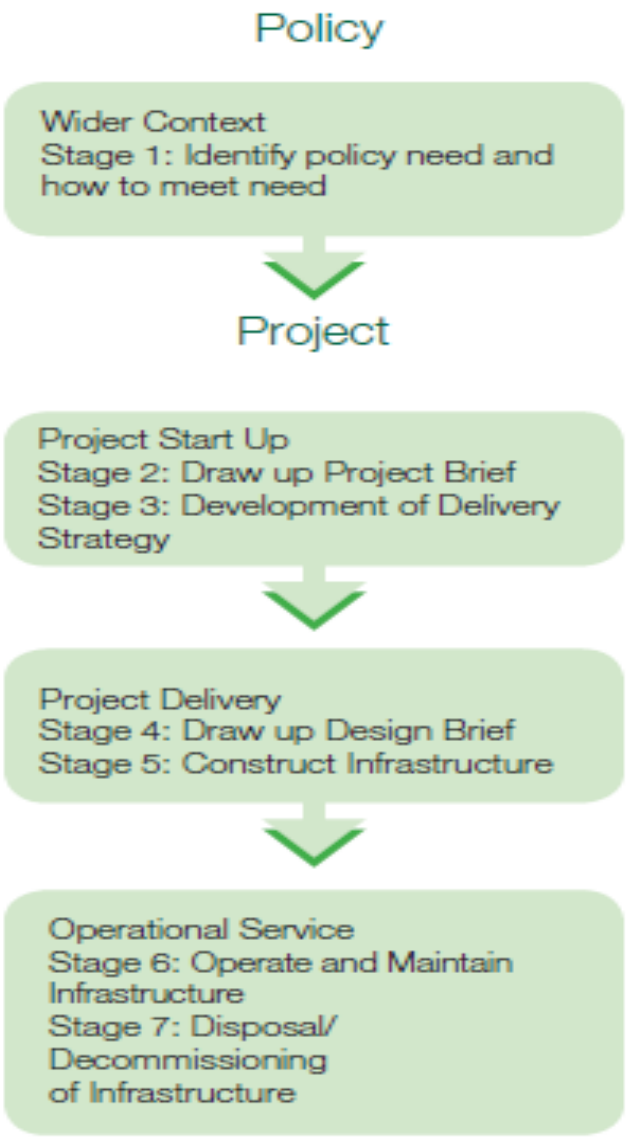
Impacts on Human environment

- Adverse impacts
  - Displacement of local populations may threaten the sustainability of community structures/cultures
    - displacement can happen in the immediate surrounds or across a wider area, for example if a dam reduces water flow and disrupts community life downstream.
  - Construction may impact on archaeological /heritage sites with architectural or historical importance
  - Once built, infrastructure can have negative impacts on the local community -- a road generates traffic which can be a nuisance and hazard for the local community
  - There can be health effects (real or potential, in the event of an incident) from infrastructure on the local community
  - Health and safety considerations for the workers

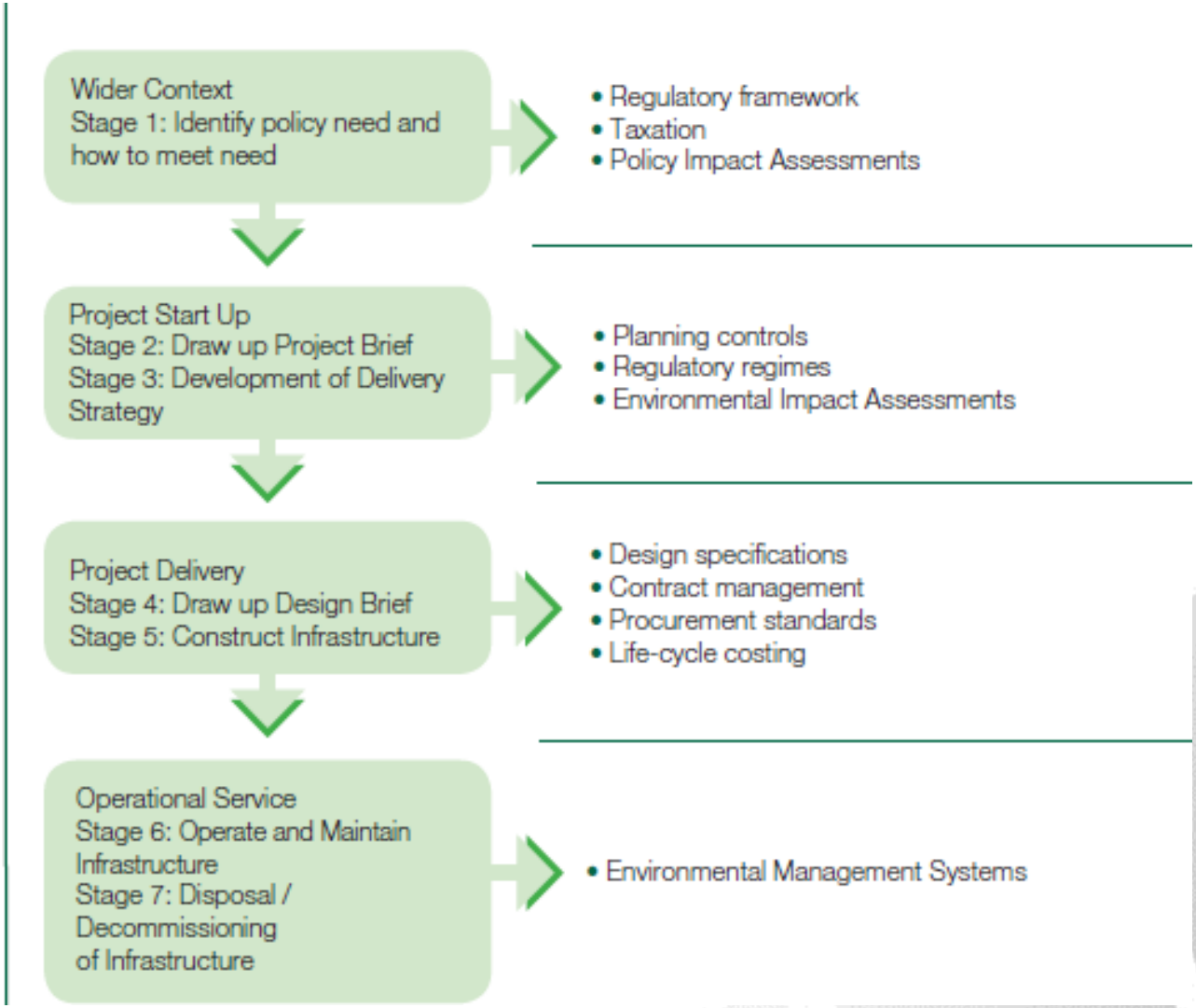
Impacts on Human environment

- Positive impacts
  - Developer of the infrastructure may pay tax, provide other support to the local community.
  - Construction can strengthen the local economy through using local companies and local employees at all stages of the infrastructure lifecycle.
  - New infrastructure may bring additional people, employment and tourism into the economy and the opportunity to invest in local services to support the increasing community, such as education, health care facilities and housing.
  - The presence of infrastructure such as a railway or a power station may affect property prices (may be a positive or adverse effect).

Stages in infrastructure development



Managing environmental impacts of infrastructure



Addressing policy impacts

- Commitments to MEAs
  - Ramsar Convention on Wetlands
  - Convention Concerning the Protection of the World Cultural and Natural Heritage
  - Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
  - Convention on Biological Diversity
- Environmental taxes or other forms of financial incentives and disincentives
- Policy impact assessments

Putting in Planning controls

- Regulation of land-use change through planning laws
- Setting conditions which must be met if planning approval is to be granted and conditions which apply following the approval to build
- Complementary actions or payments to fund them by infrastructure development company

Putting in place environmental regulations

- Environmental permits
  - may be required for the construction or operation of a regulated infrastructure facility such as a water treatment plant or waste handling plant
- Trade effluent consents and agreements
  - may be required for operations or activities that discharge trade effluent into the public foul sewer
- Water abstraction and impoundment licences may be required
  - for infrastructure building or operations that take water from surface waters or groundwater, or obstruct them in any way
- Waste carrier, broker and dealer registration may be required for the transport of waste
- Operations that produce or move hazardous waste generally require hazardous waste registrations

Environmental and sustainability assessments

- Environment Impact Assessments
  - Process which ensures that the likely effects of a specific new development on the environment are fully understood and taken into account before the development is allowed to go ahead
  - Enables environmental factors to be given due weight, along with economic or social factors, when planning applications are being considered.
  - Mandated by law for large infrastructure projects
- Social or sustainability impact assessment
  - an additional tool which may be used to widen the scope of an environmental assessment to incorporate concepts of community, health and wellbeing, culture and the human environment

Environmental and sustainability assessments

- Life-Cycle Assessment: can include
  - consideration of construction materials, air emissions, water effluents, climate change impacts, solid waste, and the consumption/depletion of energy and other resources and be used to help to ensure that a government's choices are environmentally sound, whether in the design, manufacture or use of a product or system
- Cost-Benefit Analysis
  - Techniques exist to convert these identified impacts and remediation costs into monetary terms, so that they can be brought into a Cost-Benefit Analysis.

Environmental and sustainability integration in design and procurement

- Design phase: opportunity to influence the environmental and sustainability performance of an infrastructure development
  - Enhancing biodiversity, through green cover
  - Incorporating energy saving features
  - Using, where possible, materials with low environmental impact e.g. materials that: 1) have low embodied energy; 2) can be sourced locally; 3) maximise the use of recycled products; and 4) have a long life and low maintenance requirements
  - Minimising waste both during construction, operation, maintenance and demolition, recycling of waste material during operation stage
  - Incorporating water saving features both for consumption and discharge of wastewater; and incorporating grey water recycling and rainwater harvesting

Environmental and sustainability integration in design and procurement

- Procurement process: Governments can use this to drive efficiency of suppliers, ensure environmental and sustainability considerations built into construction
- Includes
  - Design of specifications
  - relevant evidence of technical capability to deliver the environmental specifications during tendering process
  - Contract conditions should be used to ensure suppliers provide appropriate information on their performance against environmental/sustainability requirements

Mechanisms for ongoing monitoring and evaluation of environmental and sustainability impacts

- Use of Environmental Management System (EMS): to routinely monitor environmental performance and improve and control it
- ISO developed an internationally accepted standard for implementing an effective EMS, known as ISO 1400123, main requirements for which are
  - Formulate an environmental policy, which formally outlines its commitments to environmental management
  - Identify its significant environmental impacts – for example energy consumption, emissions to air, water pollution, waste, water consumption, resource consumption
  - Set measurable objectives to reduce its environmental impacts, with quantified targets in all significant impact areas
  - Review and report internally its environmental performance and carry out internal auditing where appropriate

Audit of infrastructure projects by SAIs

- Audits of the national approach to infrastructure planning
  - review their government's approach to prioritisation of national infrastructure investment
    - examining the evidence of the need for the investment and the identification and monetisation of the costs and benefits.
    - Audits may address processes for mobilising resources from public expenditure and private sources and any barriers likely to affect delivery and government action to tackle them
  - Eg: The Australian National Audit Office reviewed the work of Infrastructure Australia in undertaking the first National Infrastructure Audit and developing the first Infrastructure Priority List

Audit of infrastructure projects by SAIs

- Audits of infrastructure projects and programmes
  - audit an individual infrastructure project because of the scale of investment involved and the benefits it is expected to bring or its impact on the economy or community
  - Audits may address the quality of decision taking on investment projects and very early stage review can assess the case for the investment before a final decision to proceed and to establish the likely impacts
  - Consider the sufficiency of the benefits realization and impact mitigation arrangements

Audit of infrastructure projects by SAIs

- Examples
  - The US Government Accountability Office (GAO) carried out a study of funding options for establishing a clean water trust fund to support the increased investment needed for modernization and increasing the capacity of waste water treatment systems
  - OAG Thailand audited the Bangkok Super Skywalk Project prior to construction of the second stage to review the sufficiency of the information available to support the Bangkok Metropolitan Administration's (BMA) decision to proceed with the project

Audit of infrastructure projects by SAIs

- Audits may address projects at a later stage to provide accountability for the expenditure involved and the environmental impacts or benefits realized by the project; to identify lessons learned for the operation of the infrastructure or for the development of other infrastructure projects
- The audit may address projects as a whole or particularly focus on how the projects have addressed their environmental impacts.
- Alternatively it may address a number of such projects
- Eg:
  - The Brazilian Court of Audit (TCU) reviewed its audits of infrastructure from 2004 to 2009. The review identified the main types of non-compliance with environmental regulations that the audits had found

Audit of infrastructure projects by SAIs

- Audits may be one-off or part of a series addressing infrastructure development over an extended period
- Examples
  - The UK National Audit Office undertook a series of studies on the Preparations for the London 2012 Olympics, from the initial bid through to readiness for the Games in 2012
    - Audits examined the project at multiple stages of the infrastructure lifecycle as the project has progressed
    - The reports have addressed plans to deliver the project's commitment to achieving long term, sustainable regeneration alongside wider consideration of cost and progress against plans. Later in the project the audit included a focus on the sustainable use for the sites and the legacy from the games
  - The Estonia National Audit Office reviewed national road maintenance in 2006 and followed this up with a further review in 2012. The study assessed whether road performance had improved, including its compliance with environmental requirements

Audit of infrastructure projects by SAIs

- Audits of the operation of processes to address environmental impacts of infrastructure
- SAIs may undertake audits of compliance with and effectiveness of laws and regulations and other governance frameworks
- Examples
  - The Brazilian Court of Audit examined the performance of the federal environment agency (IBAMA) in carrying out Environmental Impact Assessments
  - The US Government Accountability Office carried out a study of the time taken to complete highway projects. This examined the many factors contributing to the length of time taken to complete highways investment projects and the effectiveness of provisions to expedite it, including streamlining of some elements of the environmental review process.

Audit of infrastructure projects by SAIs

- Audits can also address organisations' compliance with good practice governance tools in their infrastructure projects in order to identify whether reliance on such voluntary approaches can be effective and identify any barriers to their effectiveness
- Examples
  - The US Government Accountability Office (GAO) carried out a survey across major airports to identify trends in their consideration of environmental impacts in planning decisions, following environmentally sustainable standards and implementing Environmental Management Systems
  - The UK National Audit Office undertook a study of central government organisations' compliance with administratively required governance structures and standards for procurement and contract management to ensure sustainable construction and refurbishment of the government estate

Audit of infrastructure projects by SAIs

- Audits of infrastructure projects' contribution to achievement of environmental objectives
- SAIs can undertake audits of performance in meeting environmental objectives, which address infrastructure projects' achievements alongside the results from other policy tools to deliver the intended outcome
- Examples
  - The New Zealand Audit Office audited a sample of Local Authorities to examine whether they were effectively managing supplies of drinking water to meet the likely future demand
  - The Estonia National Audit Office audited the development of waste water treatment in rural areas with the support of the Cohesion Fund. The audit covered 63 local authorities and evaluated the preparation, instigation and financial stability of the waste water treatment systems developed.

Thank you