Analyzing Life-cycle Environmental Impacts of Local development Initiatives Using Regional Economic and Environmental Input-Output models

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Research Goals

- Every development project has economic and environmental impacts
- Informed decision making requires the community and planners to consider and evaluate both impacts
- The goal is to develop a watershed information tool (WIT) to help estimate these impacts

Research Components

- Economic impact analysis module (Conventional Regional IO model)
- Environmental database
- User friendly software development
- Case studies illustrating the use of the tool

Project Effects

- Direct effects
  - Directly due to project activities
- Indirect effects
  - Due to increases in the outputs of industries supplying inputs to the project activities
- Induced effects
  - Additional household income will lead to increased consumption expenditures and increased output of food, clothing etc.
- Local effects v/s Total effects
- One time activities v/s continuing activities

Economic Impact Module

- Regional input-output model for the Muskegon River Watershed
- Special watershed level dataset
- 78 zip code areas over 13 counties
- 528 sector detail
- Based on national technical coefficients, adjusted with a regional purchase coefficient vector.

Economic Impact Module

- Input
  - Project cost components [Labor, different materials, services]
- Output : Direct, Indirect and Induced effects on
  - Local employment
  - Output of various sectors
  - Local wage income, other income
  - Business Tax revenues

Environmental Impact Module

- Increased production and consumption imply increased pollutant emissions and resource use
- Estimate emission factors and resource use intensities for different sectors and households
- Link with economic module to estimate total changes in emissions and resource use

Environmental Impact Module

- Air, water, land emissions
- Energy, minerals, water consumption
- Summary indices
  - Global warming potential, Acidification potential, eutrophication, toxicity weighting, total energy
- Monetary valuation
- Carnegie Mellon University's EIO-LCA+

Software

- Input [Project cost estimates]
- Identifying appropriate industry sectors
- Economic impact analysis (RIO model)
- Environmental impact analysis
- Output Reports generation

Case Study: Middle branch River Restoration

- Tributary of Muskegon River
- 33 Miles long, Osceola County
- Old dam in Marion Village
- Mill Pond 26 acres
- Dam is unused, safety hazard, thermal pollution (6-9 degrees higher), No cold water fish down stream
- Mill pond is sediment filled, shallow, doesn't support fish or recreation

Project Components

- Dam Removal and River restoration
- Mill pond retaining berm construction
- Mill pond dredging and restoration
- Recreation facilities [Walkway, bridge, fishing platforms, boat launch area]


MIDDLE BRANCH RIVER
MARION
MILL POND
MILL STREET
WALKWAY
WATER STREET
PARKING AREA

Project Cost

- Feasibility study by Progressive AE, Grand Rapids
- Estimated cost $4.28 million
- Estimated direct labor costs $2.02 million
- River restoration +berm =$1.988 million
- Pond Restoration = $2.043 million
- Recreation Elements=$0.487 Million

Project cost components

Labor	$ 2,023,000
Equipment Rental	$ 804,750
Sand & Gravel	$ 165,520
Ready mix concrete	$ 48,000
Steel	$ 70,000
Dimension Stone	$ 284,000
Engg services	$ 500,000

Economic Impacts

- Local Employment Generation (annual FTE)
  - Direct = 47.8
  - Indirect = 24.2
  - Induced = 5.6
  - Total = 77.6
- Local Economic Output $1.98 Million
- Local Personal Income $0.089 Million
- Indirect Business Taxes $0.073 Million

Environmental Emissions (indirect + Induced)

Energy use	4.04 TJ
Conv. Pollutants	4.86 MT
GHG emissions	305.35 MT CO2eq
Fuels	3.77 TJ
RCRA Wastes	0.41 MT
Toxic Releases	0.016 MT
Toxic Releases (wtd)	0.097 MT CMUET

Direct Environmental Benefits

- Main direct ongoing benefit is restoration of 16 miles of cold water fishing stream
- Other benefits are
  - Safety risk reduction, Habitat improvement for other species, Sediment, nutrient, water quality improvement, Aesthetics
- Mostly estimated outside the WIT

Michigan Angling Demand Model

- Estimates effect of water quality changes on fishing trips statewide by type and county
- 16 miles cold water fishing stream restoration will result in about 2051 fishing days increase in Osceola county
- Using an estimated average spending/visit we also calculate ongoing annual economic and environmental impacts

Assessing products (LCA) v/s local development initiatives

- IO approach is valuable since both economic and environmental impacts can be quantified.
- Local effects and induced effects are important
- Assessing direct effects and ongoing effects may be more complex

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