Estimation of Performance Indices for the Planning of Sustainable Transportation Systems
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Objective

- In simple words, the objective of this research is the estimation of performance indices for the planning of sustainable transportation systems.
- Sustainability is achieved when the Transportation system, Activity system and Environmental system have all reached minimum and stable levels of quality so that they can continue operating in perpetuity at less than these levels.

Introduction

- What is sustainable transportation system?
- Fulfill the needs of current generations without compromising the ability of future generations.
- Utilize resources without compromising their health and productivity.
- Leads to development that improves quality of life.
- Assimilate economic, ecological, social, and bio-physical components of resource ecosystems.
- Minimize the use of renewable and non-renewable resources, provide affordability, and equity between generations.
- No consensus is available.

Methodology

Transportation System
- Vehicle miles travel per lane mile
- Transportation service index
- Personal spending on transportation

Activity System
- Income (GNI/capita)
- Education
- Life Expectancy

Environmental System
- Greenhouse gases (CO₂)
- Air Pollutants (CO, NOₓ, SO₂, PM₁₀, VOC)
- Water Pollutants (BOD)
- Energy Consumption

Fuzzy Logic: Membership Functions for Transportation System

RHS (then part) consequent

LHS (if part) antecedent

Analysis and Results

Composite Sustainability Index

Policy Options

1. Use of non-motorized and alternate modes of transportation
2. VMT fee
3. Efficient boilers for coal fired plants
4. Use of alternative fuel such as CNG
5. Use of hybrid and battery powered vehicles

Concluding Comments

- This study computes performance indices for a system of systems including Transportation, Activity and Environmental systems.
- Additional performance measures can be incorporated based on spatial and demographic characteristics.
- The framework used in this study is currently being extended to enable the analysis of regional systems.
- A simulation based framework has been developed to estimate multiple performance measures required to estimated desired performance.
- Analyze the interactions between multiple systems using mathematical modeling (predator-prey techniques).

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