Developing Indicators for Modeling and Monitoring Sustainable Transport

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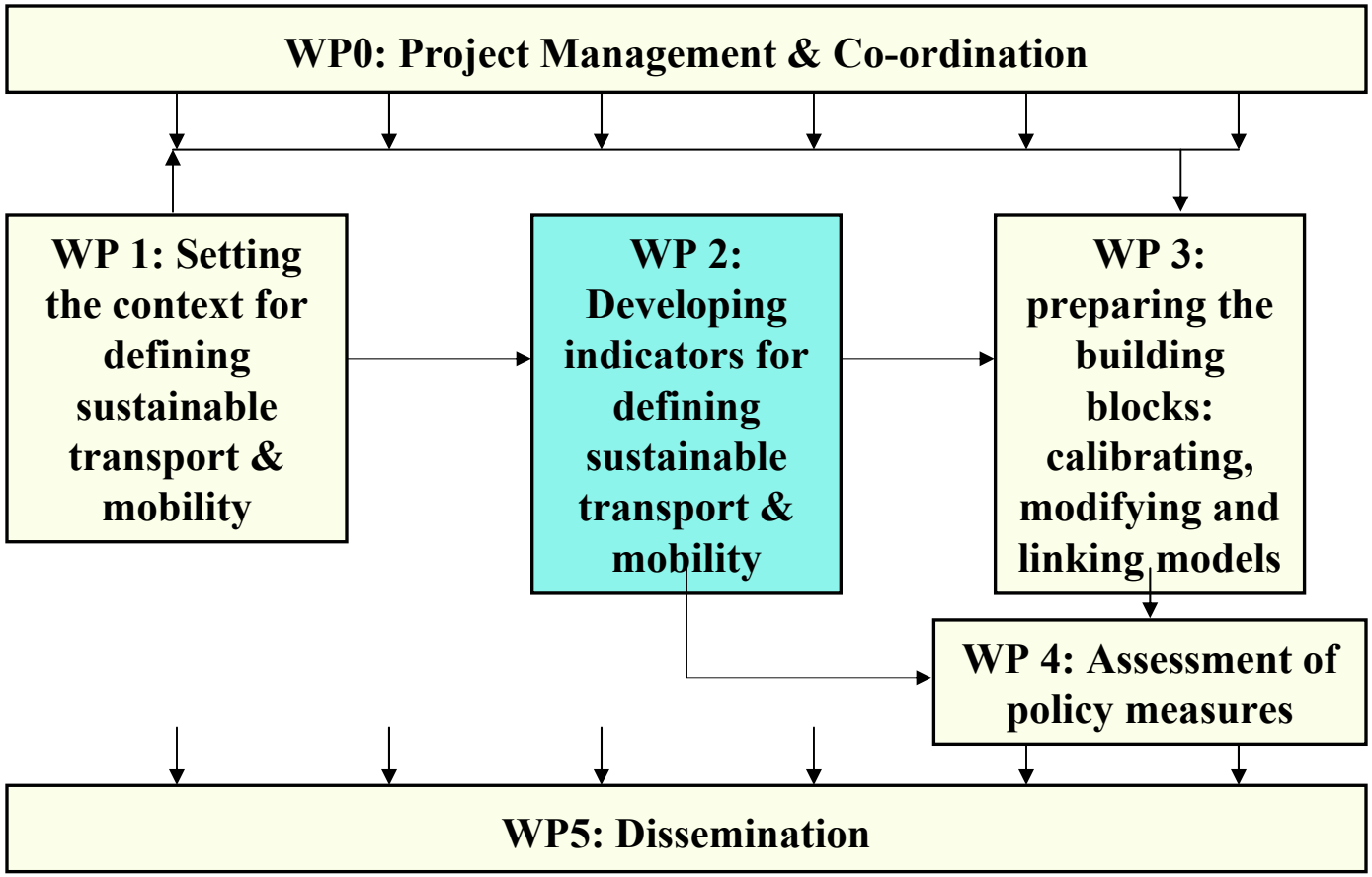
Sanna Ahvenharju, Michal Arend, Roberto De Tommasi, Rik van Grol, Adnan Rahman, Wolfgang Röhling, Warren Walker

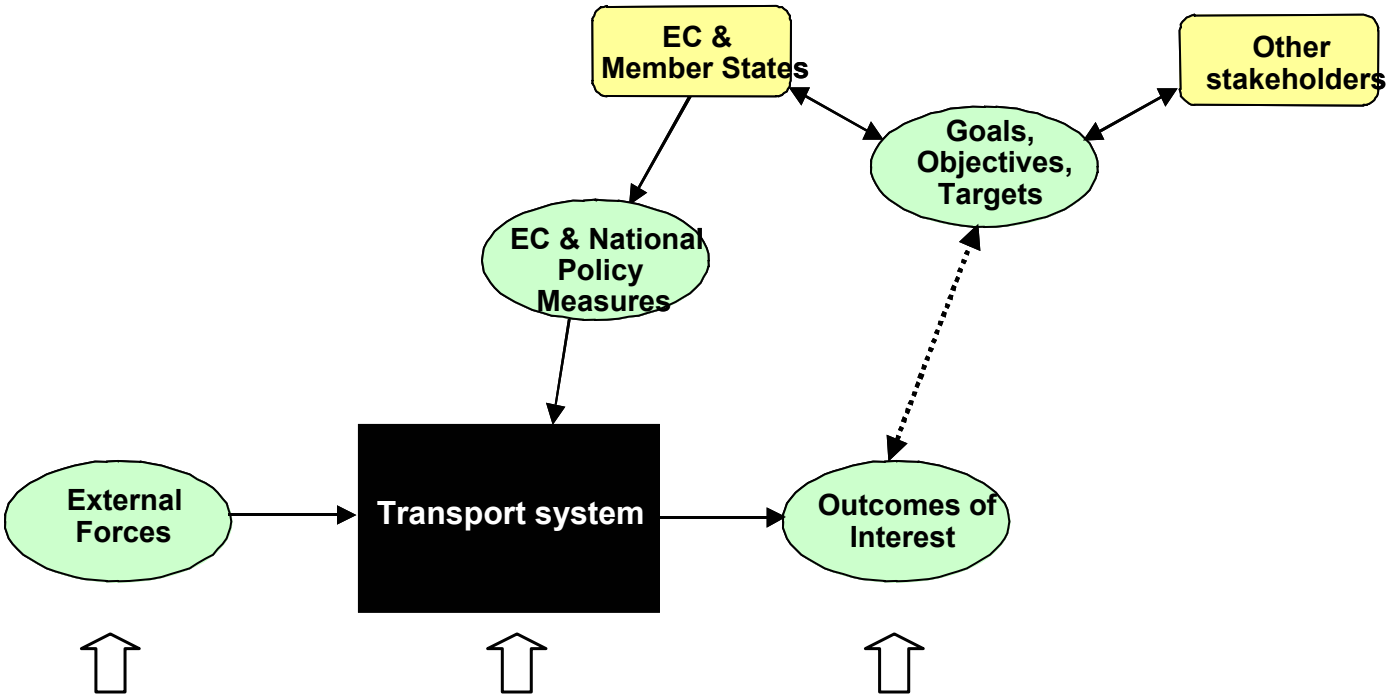
Outline

- The need for indicators for ex-ante and ex-post analysis of sustainability
- Indicator development
- Selected indicators
- Next steps in modeling and monitoring

SUMMA Tasks


WP0: Project Management & Co-ordination
WP 1: Setting the context for defining sustainable transport & mobility
WP 2: Developing indicators for defining sustainable transport & mobility
WP 3: preparing the building blocks: calibrating, modifying and linking models
WP 4: Assessment of policy measures
WP5: Dissemination

Three Types of Indicators in SUMMA

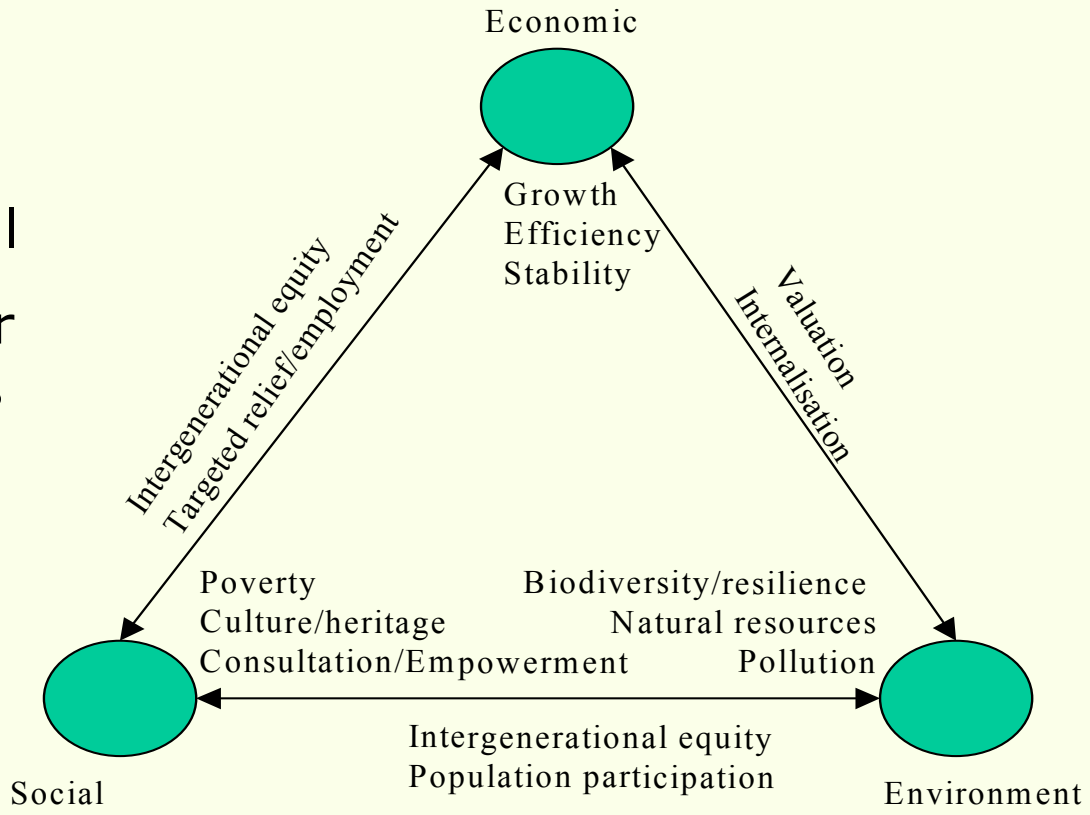


Uses of the Indicators

- For modeling (ex-ante policy analysis)
- For monitoring (ex-post policy analysis)

The Three Dimensions of Sustainability

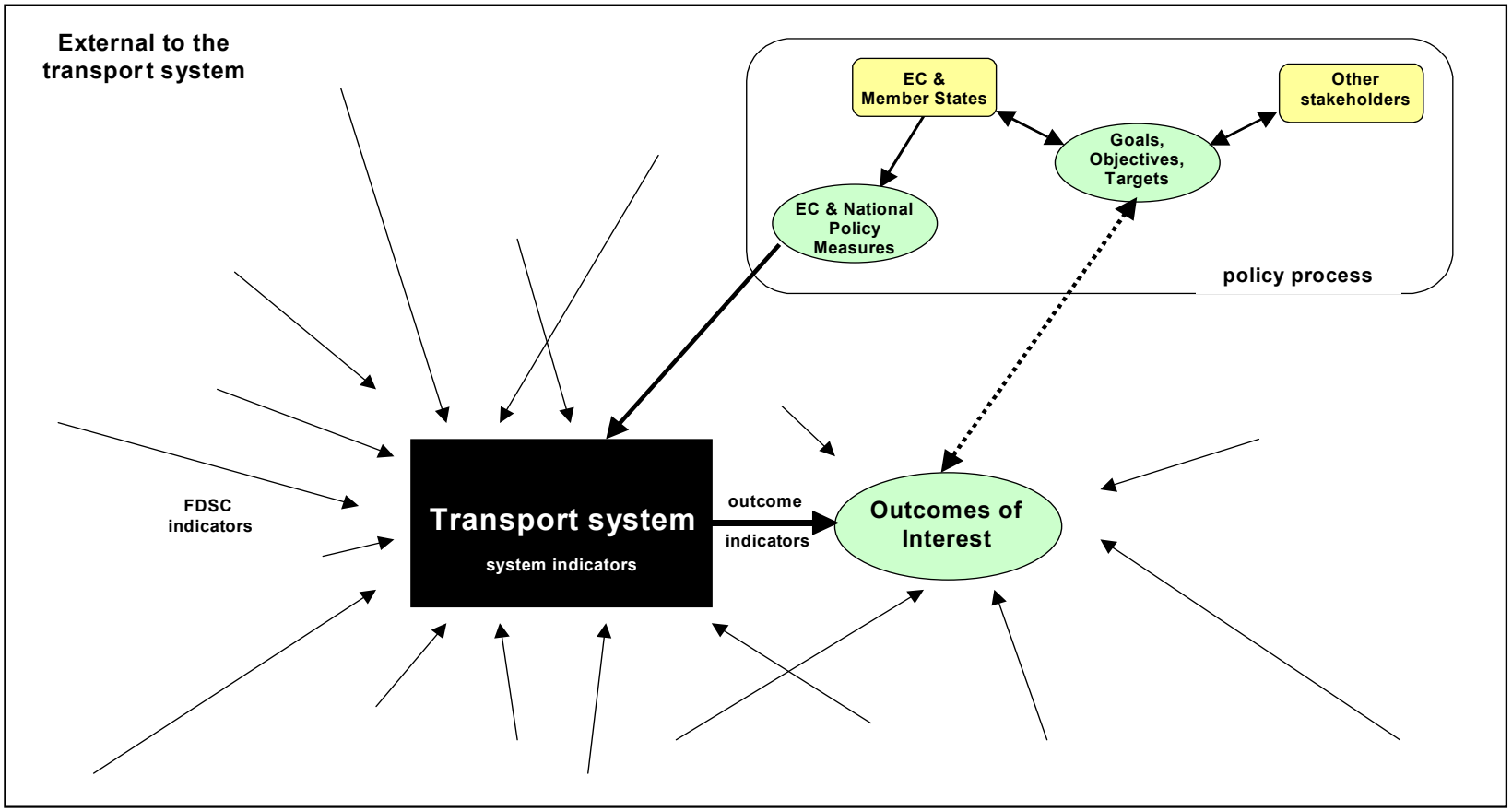
- Environmental, economic, and social
- Policy outcomes for all three dimensions have to be considered simultaneously (not sequentially or independently)



Sustainable Transport and Mobility: Goals/Outcomes of Interest

Economic	Environmental	Social
• Accessibility • Transport operation cost • Productivity / Efficiency • Costs to economy • Benefits to economy	• Resource use • Direct ecological intrusion • Emissions to air • Emissions to soil and water • Noise • Waste	• Accessibility and affordability • Safety and security • Fitness and health • Liveability and amenity • Equity • Social cohesion

Relationship Between the Outcome Indicators and the Outcomes of Interest



Principles of Outcome Indicator Development

- The set of indicators should cover all of the outcomes of interest
- Each indicator should have a clear relationship to sustainable transport
- Each indicator should be a measurable outcome of the transport system

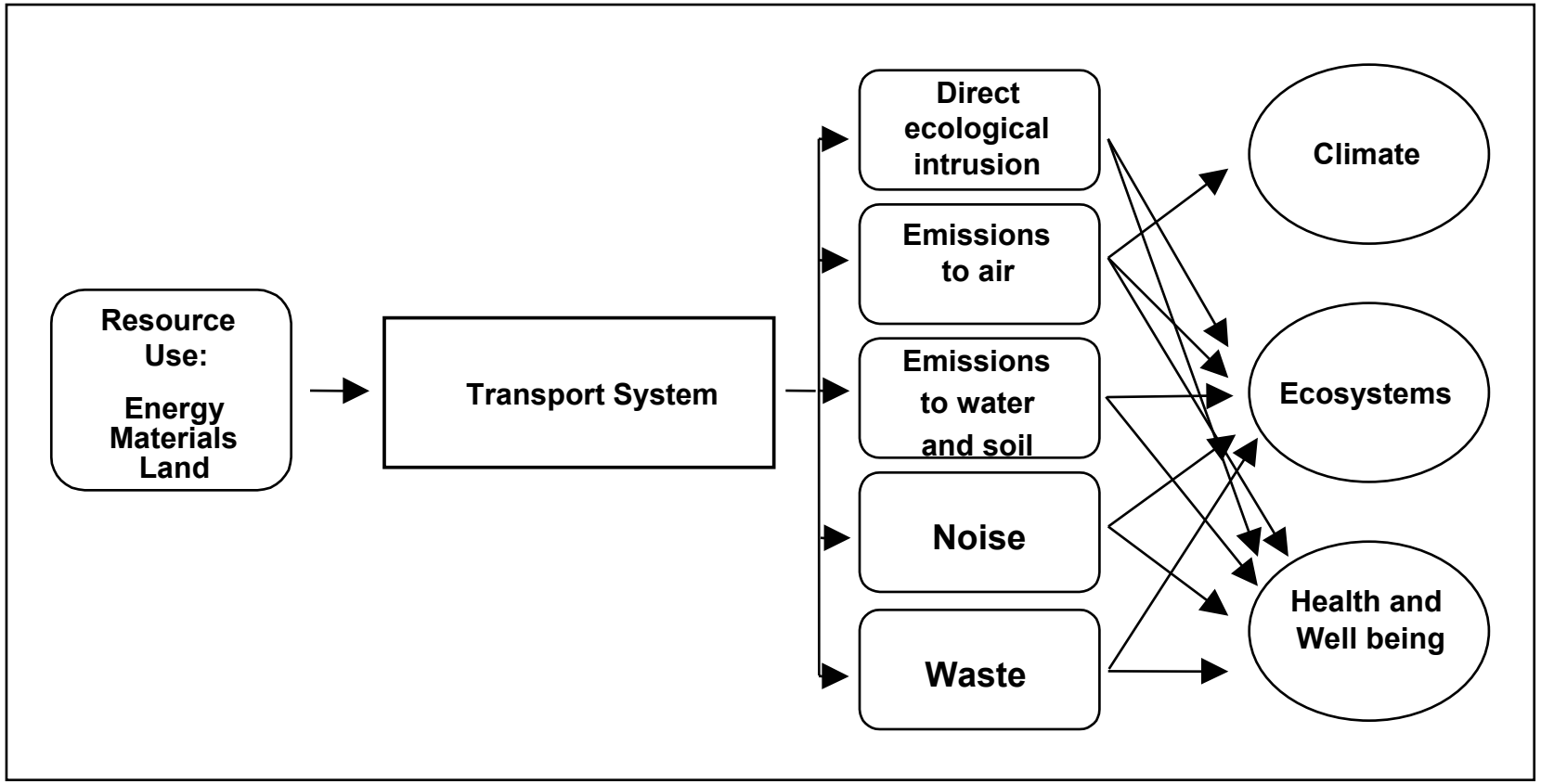
Existing data availability not critical ("wish list")

The Process of Indicator Development

- Identified several possible indicators for each outcome of interest (based on existing work whenever available)
- Screened and revised the indicators at expert and policymaker workshops
- Ended with detailed descriptions of 60 indicators in a common format

Environmental Outcome Indicators

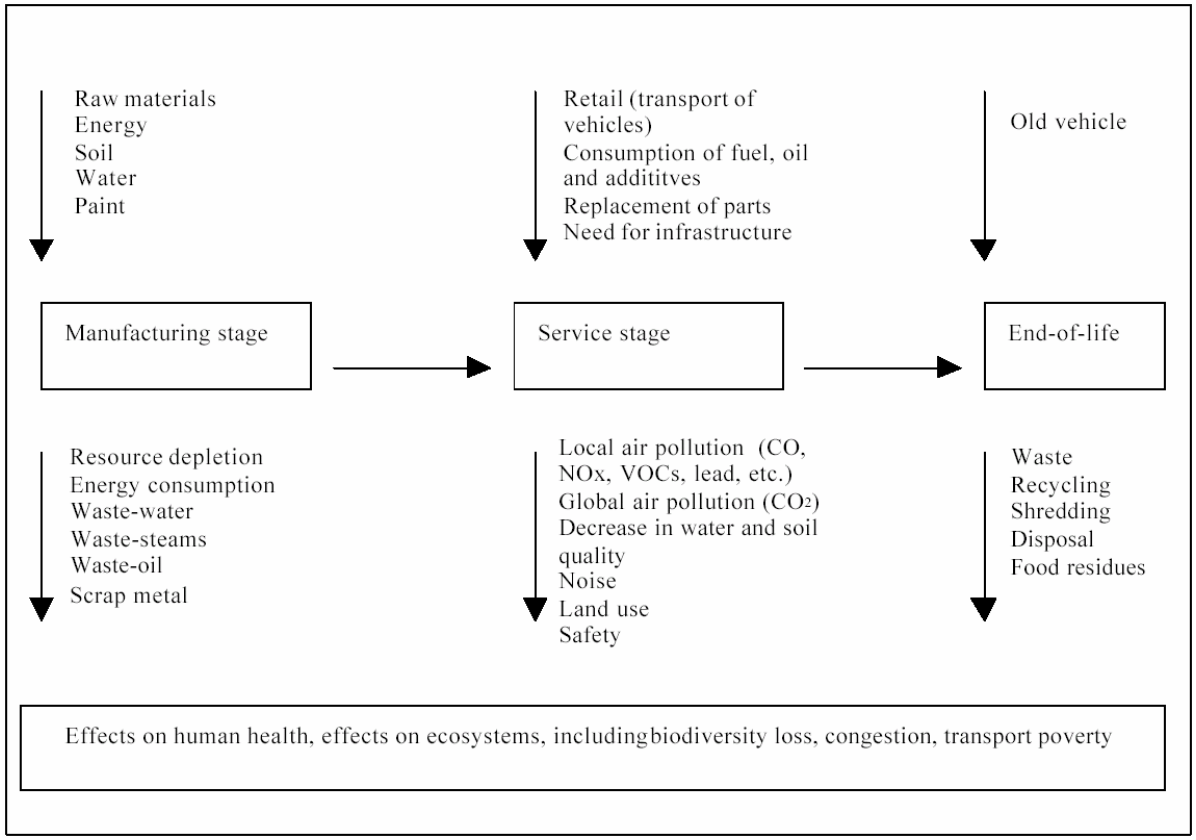
Input-Output Framework for Environmental Outcomes of Interest



New Aspects/Enhanced Emphases

- **Life-cycle thinking**
  - **Raw material consumption**
  - **Emissions from manufacture and maintenance**
- **Small but long-term impacts**
  - **Runoff impacts on soil and water quality**
- **Direct impacts on ecosystems**
  - **Dredging, light, collisions, non-native species**

Life Cycle of Vehicle Production and Use



Environmental Outcome Indicators (1)

- Resource use
  - Energy consumption
  - Consumption of solid raw materials
  - Land take
- Direct ecological intrusion
  - Fragmentation of land
  - Damage of underwater habitats
  - Losses of nature areas
  - Proximity of transport infrastructure to nature areas
  - Light emissions
  - Collisions with wildlife
  - Introduction of non-native species

Environmental Outcome Indicators (2)

- **Emissions to air**
  - Transport emissions of greenhouse gases (GHG)
  - GHG emissions from manufacture and maintenance
  - Transport emissions of air pollutants
  - Air pollutant emissions from manufacture and maintenance
- **Emissions to soil and water**
  - Hardening of surfaces
  - Polluting transport accidents
  - Runoff pollution from transport infrastructure
  - Wastewater from manufacture and maint. of transp. infrastruct.
  - Discharges of oil at sea
  - Discharges of waste and wastewater at sea

Environmental Outcome Indicators (3)

- **Noise**
  - **Exposure to transport noise**
- **Waste**
  - **Generation of non-recycled waste**

Economic Outcome Indicators

Relevant Economic Aspects of Sustainable Transport

- Costs and benefits of transport for society and individuals (economic development)
- Efficiency of the transport sector
- Quality of transport services

Economic Outcome Indicators (1)

- **Accessibility**
  - Intermodal terminal facilities
  - Accessibility of origins/destinations
  - Access to basic services
  - Access to public transport
- **Transport operation costs**
  - Supplier operating costs
  - Transport-related expenditures of households
  - Transport prices

Economic Outcome Indicators (2)

- **Productivity/Efficiency**
  - Freight haulage-related costs on product costs
  - Utilization rates
  - Energy consumption efficiency of transport sector
  - Energy intensities by mode (freight/passenger)
- **Costs to economy**
  - Infrastructure costs
  - Public subsidies
  - External transport costs

Economic Outcome Indicators (3)

- **Benefits to economy**
  - **Gross value added**
  - **Public revenues from taxes and traffic charging**
  - **External benefits of transport**

Social Outcome Indicators

Difficulties in Specifying Social Outcome Indicators

- Literature only recently developing
- No agreement on what social sustainability means
  - Not only stability and balance
  - Also change and development
- Equity is a fundamental aspect
  - Horizontal (within current generation)
  - Vertical (across generations)

Social Outcome Indicators (1)

- **Accessibility and Affordability**
  - Access to basic services
  - Access to public transport
  - Car independence
  - Affordability
  - Trip length
- **Safety and Security**
  - Accident-related fatalities and serious injuries
  - Vehicle thefts and other crimes
  - Security on public transport

Social Outcome Indicators (2)

- **Fitness and Health**
  - **Walking and cycling as transport means for short-distance trips**
- **Livability and Amenity**
  - **Walkability, pedestrian friendliness**
  - **Traffic calming**
  - **Children's journey to school**
  - **Open space availability and accessibility**

Social Outcome Indicators (3)

- **Horizontal and Vertical Equity**
  - Horizontal equity (fairness)
  - Vertical equity (income)
  - Vertical equity (mobility needs and ability)
- **Social Cohesion**
  - Transport individualism ('traffic loneliness')
  - Public opinion profile on transport and transport policy issues
  - Violation of traffic rules
  - Long distance commuting

Selected Passenger System Indicators

System indicator	Influenced box in the transport system
Percentage of people with work location outside household	Activities
Percentage of people currently in education	
Age distribution	
Percentage of population owning a car	
Disposable income distribution	
Regional distribution of industries	Spatial and time structure
Percentage of population living in urban areas	
Regular shop opening hours	
Mean distance to closest public transport stop	
Residential space per person	
Fuel/energy usage per 100 km	Transport means and services
Emission of air pollutants by transport mean	
Space per passenger on public transit	
Vehicle fleet mix by mode	
Age distribution of vehicle fleet	
Fixed and variable costs by mode per passenger	
Percentage of surface covered by infrastructure by mode	Infrastructure
Numbers of vehicles that can be operated per km per day	
Price of infrastructure use (tolls, parking fees, etc.)	
Emissions of air pollutants by industries related to transport	General - several boxes
Raw material use by industries related to transport	
Average storage capacity of gas stations	
Number of vehicles produced by mode per year	

Selected External Forces

Force Driving System Change	Influenced box in the transport system
Demographic development	Activities
Income development	
Labour force development	
Labour force participating	
Job market development	
Changes in economic structure	
Changes in the cultural characteristics of society	
Land market development	Spatial and time structure
Time routine development	
Changes in logistics systems	
Changes in location of activities	
Fuel and energy development	Transport means and services
Development of vehicle technologies	
Infrastructure development	Infrastructure
Consumer demand development	General - several boxes
Legislation	
International developments	
Climate changes	
Changes in GDP	
Innovations in vehicle and fuel technologies	
Political changes	

Next Steps in Modeling and Monitoring

- Some indicators easy to monitor, but difficult to model; others have opposite problem
- SUMMA is using existing models
  - Currently in process of identifying which indicators can be produced from models, and how
- For monitoring, need consistent data over a long period of time
  - SUMMA will recommend implementation of new data collection for some indicators

For Further Information on SUMMA

http://www.summa-eu.org/