



## Defining Sustainability for National Road Administrations

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*Publication date:*  
2012

*Document Version*  
Publisher's PDF, also known as Version of record

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*Citation (APA):*  
Gudmundsson, H. (Author). (2012). Defining Sustainability for National Road Administrations. Sound/Visual production (digital), DTU Transport.

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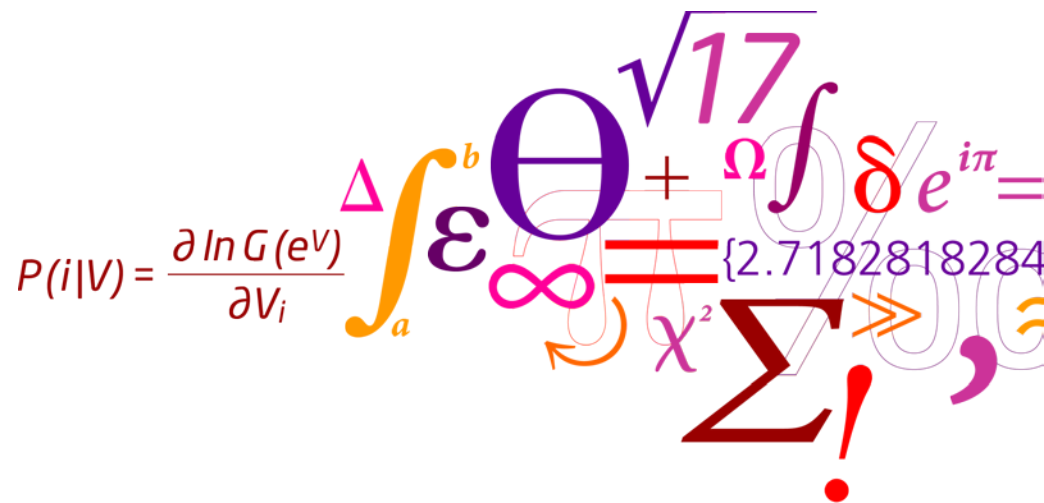
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# Defining Sustainability for National Road Administrations

Henrik Gudmundsson, DTU Transport  
**SUNRA** Workshop  
London, May 14, 2012


$$P(i|V) = \frac{\partial \ln G(eV)}{\partial V_i}$$

# Overview

- 1) **Background**, and SUNRA WP1 activities
- 2) **General** sustainability definitions
  - Policy level
  - Scientific level
- 3) Sustainability for **Transport/Mobility**
  - Challenges and definitions
  - Various approaches
- 4) Application to **NRA's**
  - Anatomy and context' of NRAs
  - Ways to 'map' sustainability to NRAs
- 5) **Discussion**: How to define sustainability for NRAs` ?

# Background

- DTU Transport, Denmark's largest transport research hub
  - Policy, Behaviour, Economics; Modelling; Safety, Logistics...
- My professional background:
  - Environmental Planning (1988)
  - Danish EPA (1988-92)
  - PhD Copenhagen Business School (2000)
- First scientific article, "Sustainable Development Principles and their Implications for Transport" (1996)
- Involved in projects on Sustainable Transport for,
  - FP6 and FP7, European Commission, European Parliament, ERANET Road; Danish Strategic Research Council, The MISTRA Foundation, Sweden; The NCHRP program (US), the Japan Society for the Promotion of Science.



# SUNRA WP1 activities

## Purpose:

- To develop a framework for defining sustainability for NRAs' by 'mapping' sustainability onto NRA context

## Elements:

- Review of literature on sustainability in general and for road systems and NRA's
- Workshop jointly with WP2 (today)
- Framework construction, Part 1

# Literature

- 1) General sustainability concepts and principles; general frameworks for sustainability
- 2) Overviews of transport/road sustainability impacts (environmental, social, economic, etc)
- 3) Typical NRA functions and task/division structures where sustainability could apply ('anatomy and context')
- 4) Transport/road specific definitions/adaptations of sustainability; Examples of NRA definitions

## Why Sustainability definitions for NRA's?

- Sustainability is a comprehensive framework for national policy an planning in EU and most countries
- Roads (and NRAs) contribute positively and negatively to sustainable development
- A unified framework to address sustainability is not in place (for most NRA's);
- Sustainability *may* provide a comprehensive key to:
  - Report performance to clients
  - Identify long terms challenges, and cost savings
  - Communicate with stakeholders
  - Integrate management internally and externally

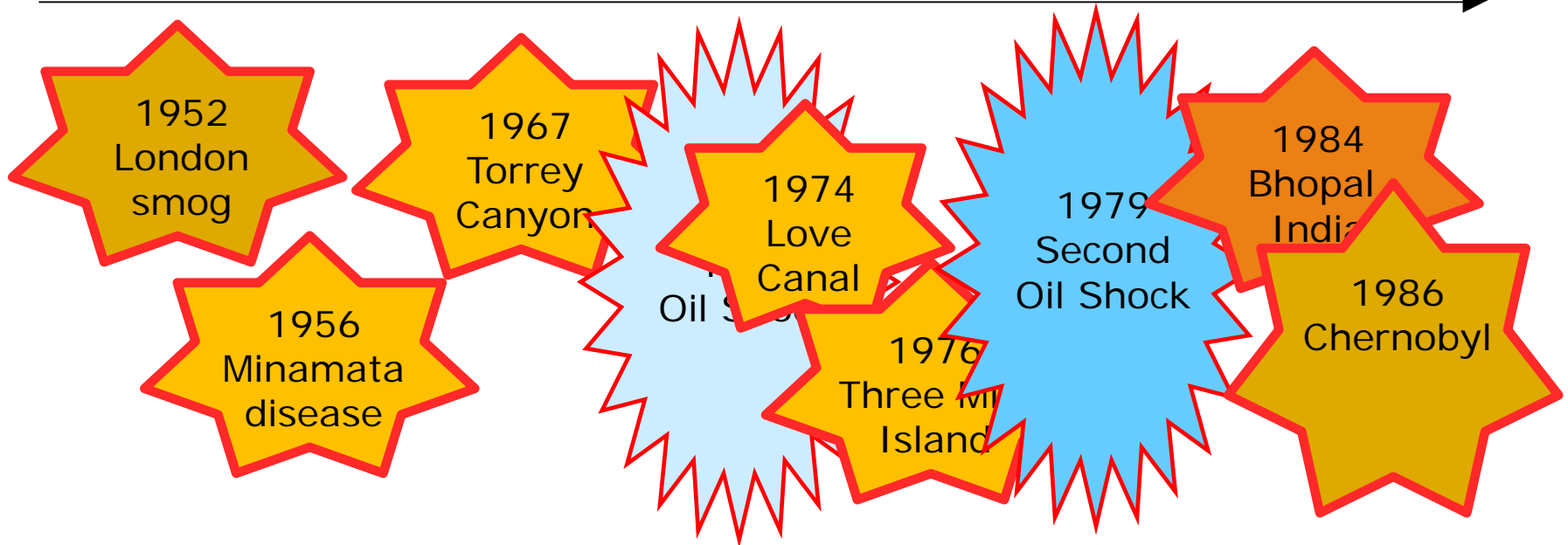
## Challenges to define NRA sustainability?

- Sustainability is complex, contested, context dependent, and rarely operationally defined
- NRAs only have limited control over factors that create or undermine sustainability ('attribution' issue)
- Sustainability **may** entail added costs, need for additional skills, or lead to more complex structures/procedures
- Pursuit of sustainability requires more than a definition

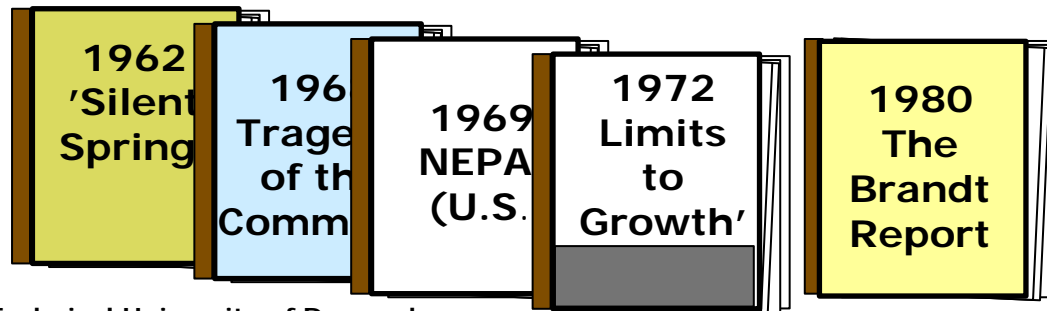


## **2) General sustainability definitions**

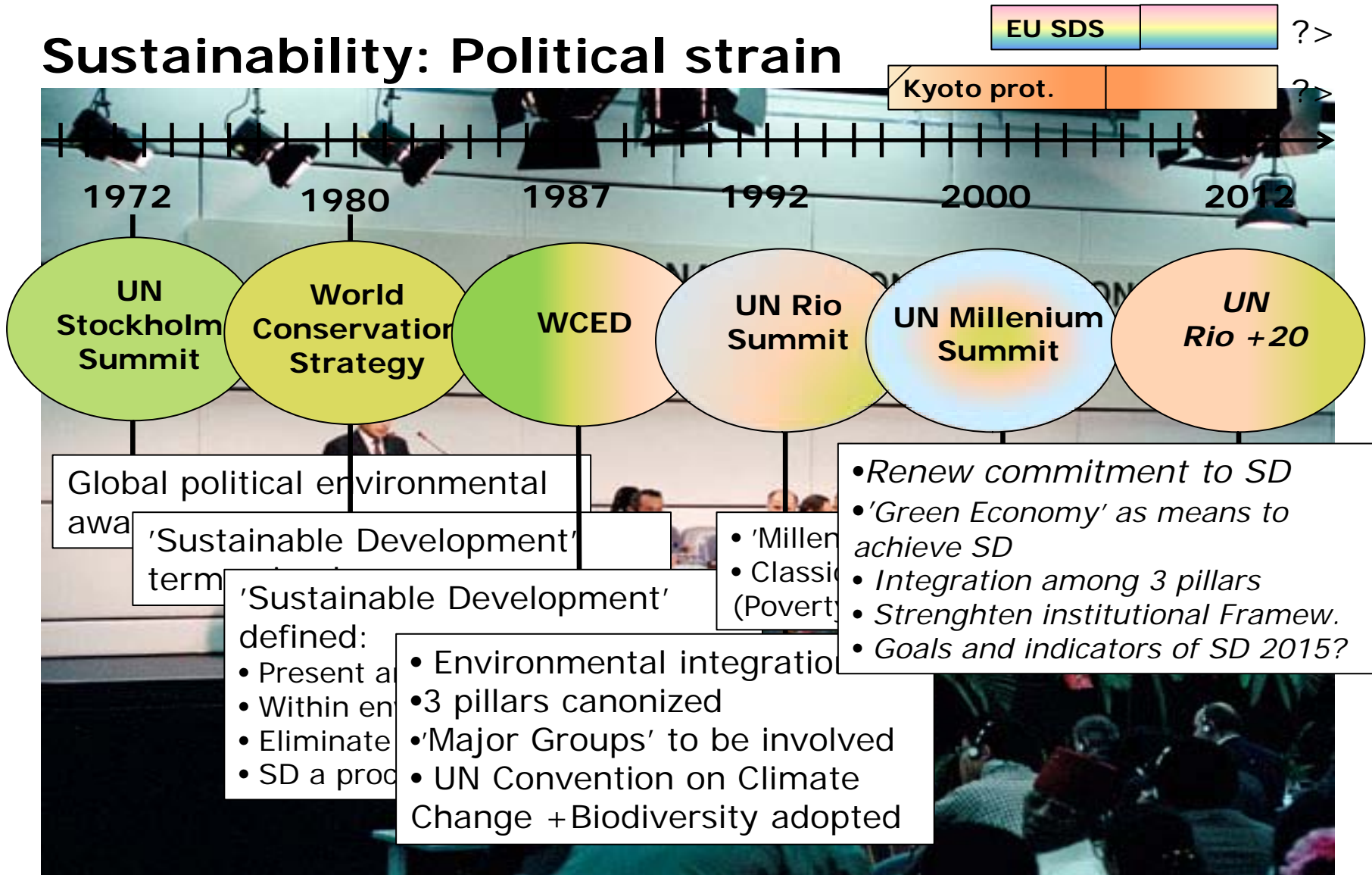
# Prehistory: Major Environmental events



# Major publications



# Sustainability: Political strain



# Defining Sustainable Development (1)



"Sustainable Development is development that meets the need of the present without compromising the ability of future generations to meet their own needs"

two key concepts:

the concept of '**needs**', in particular the essential needs of the world's **poor**, and the idea of **limitations** ... on the environment's ability to meet present and future needs

## Other 'sustainability' definitions

### **ECONOMY-BASED DEFINITION:**

- "Sustainability ...requires that the use of resources today should not reduce real incomes in the future..."  
(Pearce & Markandya 1988)

### **ECOLOGY-BASED DEFINITION:**

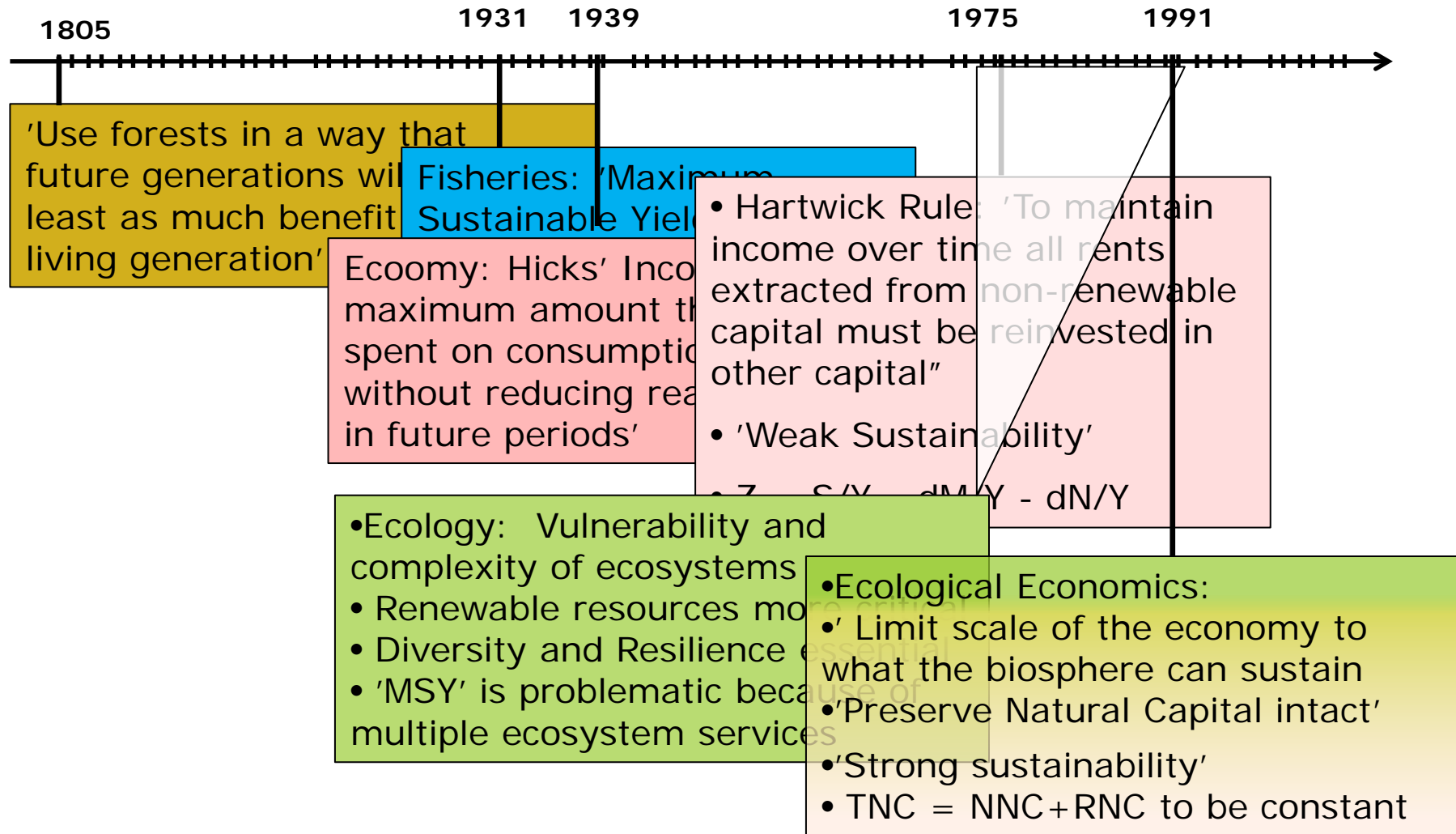
- "Sustainability is improving the quality of human life while living within the carrying capacity of supporting ecosystems" (IUCN 1991)

### **INTEGRATED DEFINITION**

- "Sustainability means to equally consider environmental aspects, social and economic aspects..... The one cannot be achieved without the other"

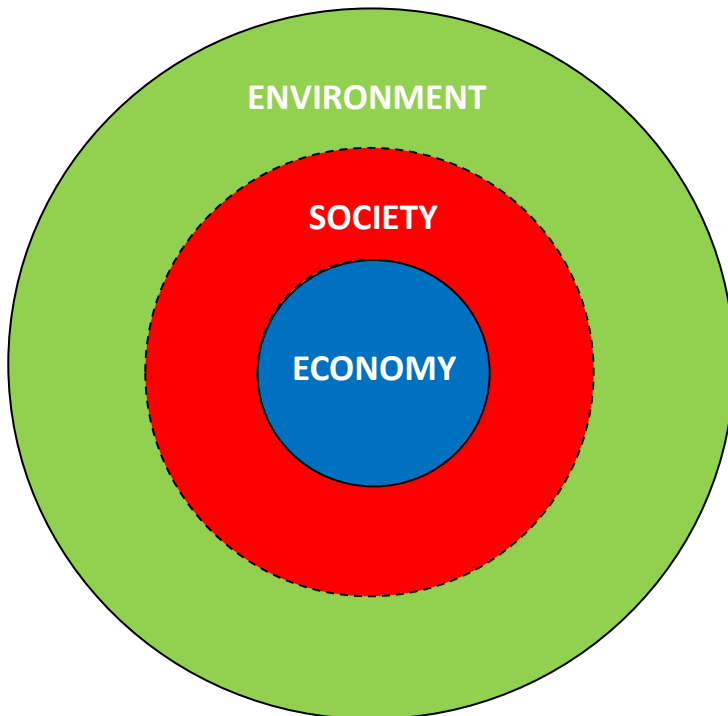
(German Council for Sustainable Development 2005).

# Sustainability: Scientific strains (1)



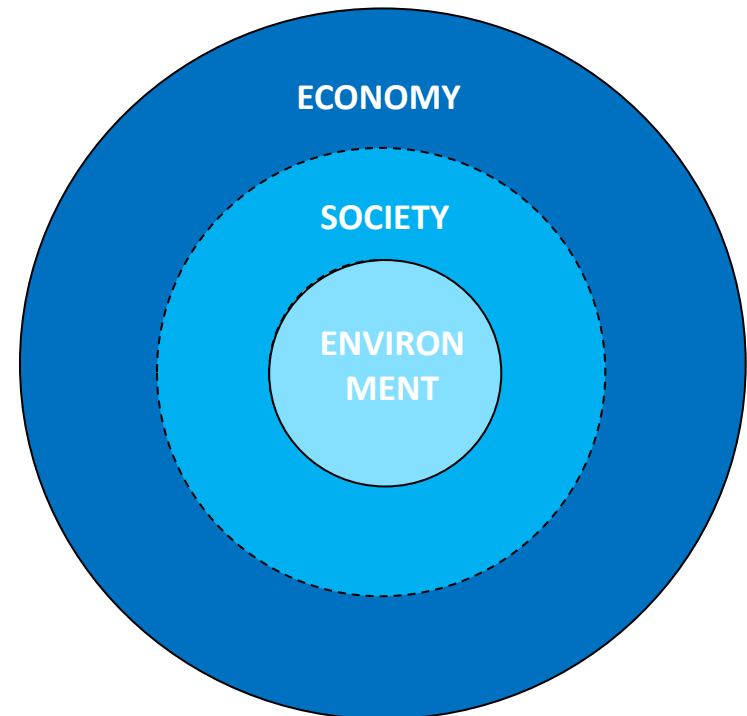
## 'Strong sustainability'

- Environment is the basis
- No substitution/trade-off
- Measure each dimension



## 'Weak sustainability'

- Human welfare is basis
- Substitution is possible
- Aggregate economic value



## Sustainability: Scientific critiques

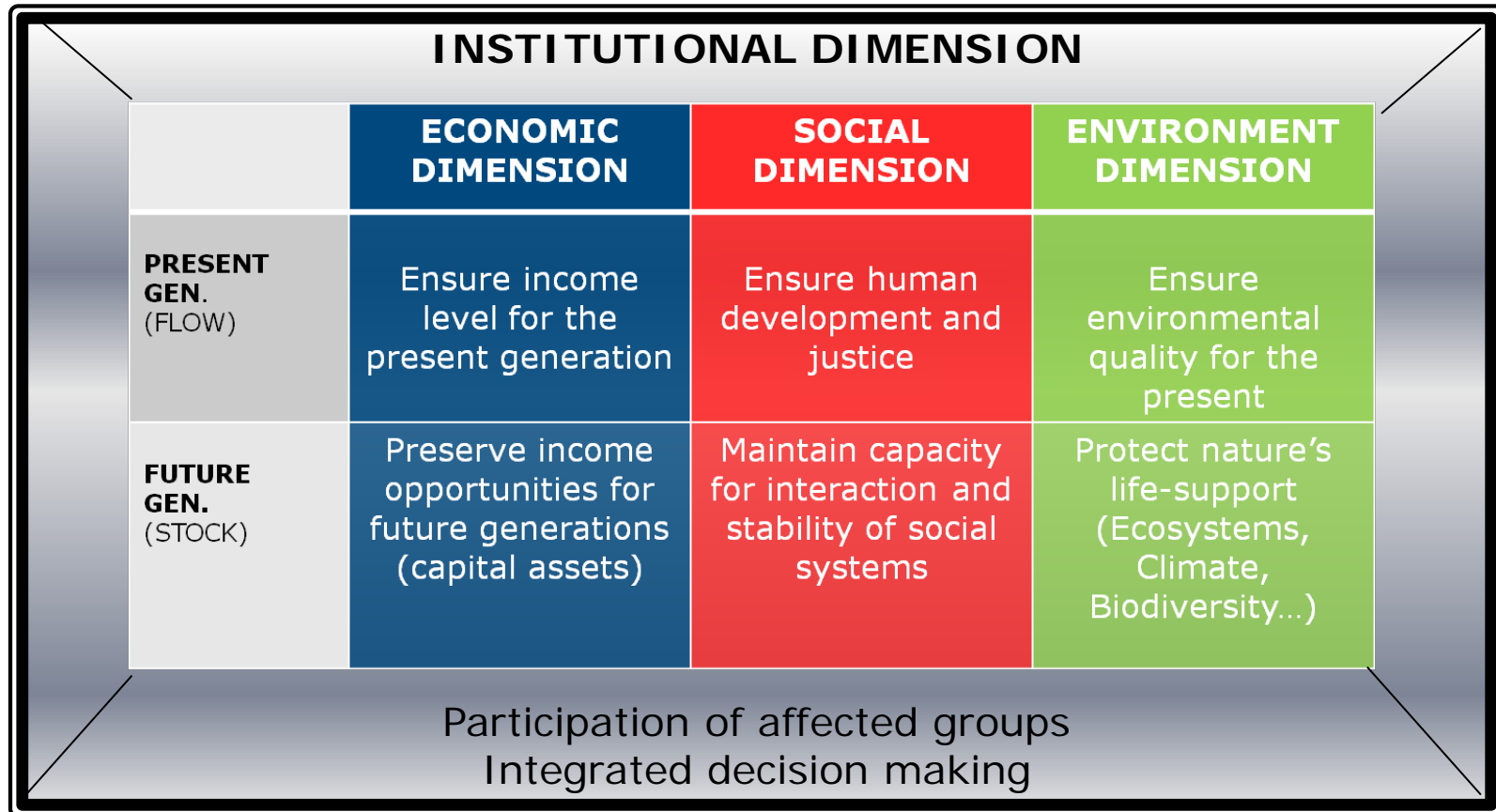
- Human **development** is **more than income** (also health, education, justice, freedom, gender balance...)
- Extremely **difficult** to define 'scales' and 'thresholds'
- *Substitutability* is mostly an **empirical** question
- The **institutional** dimension is missing....
- Hard to **distinguish** normative, analytic, strategic aspects

=> It is more **complex** than suggested by weak/strong

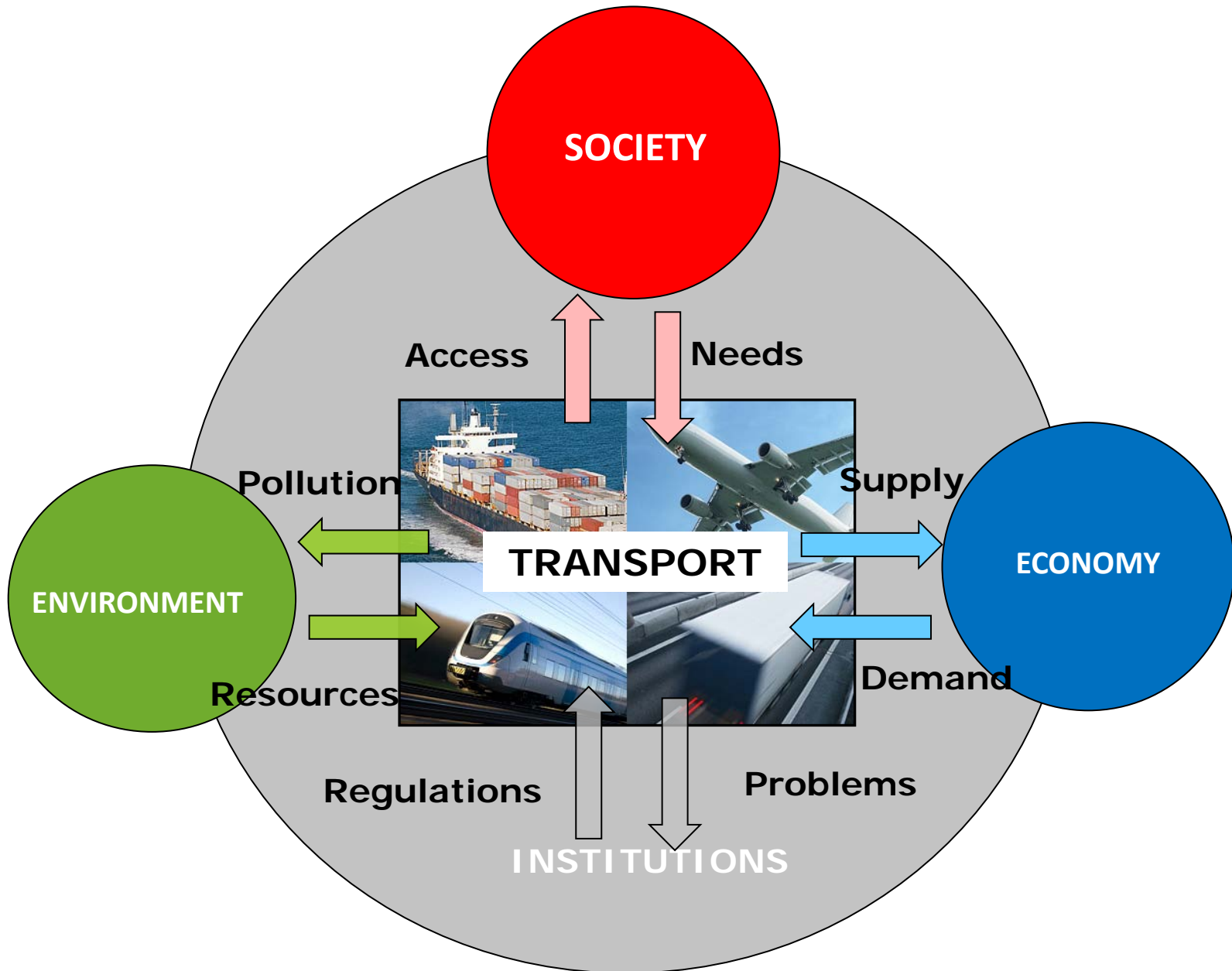
- "*...integrated decision-making is the foundational principle of sustainable development*" (Dernbach 2006)



# Sustainable Development principles



## 3) 'Sustainable **Transport**



## EU Definition of a sustainable transport system...

- allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations;
- is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development;
- limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimising the impact on the use of land and the generation of noise.

*European Council (transport) 2001*

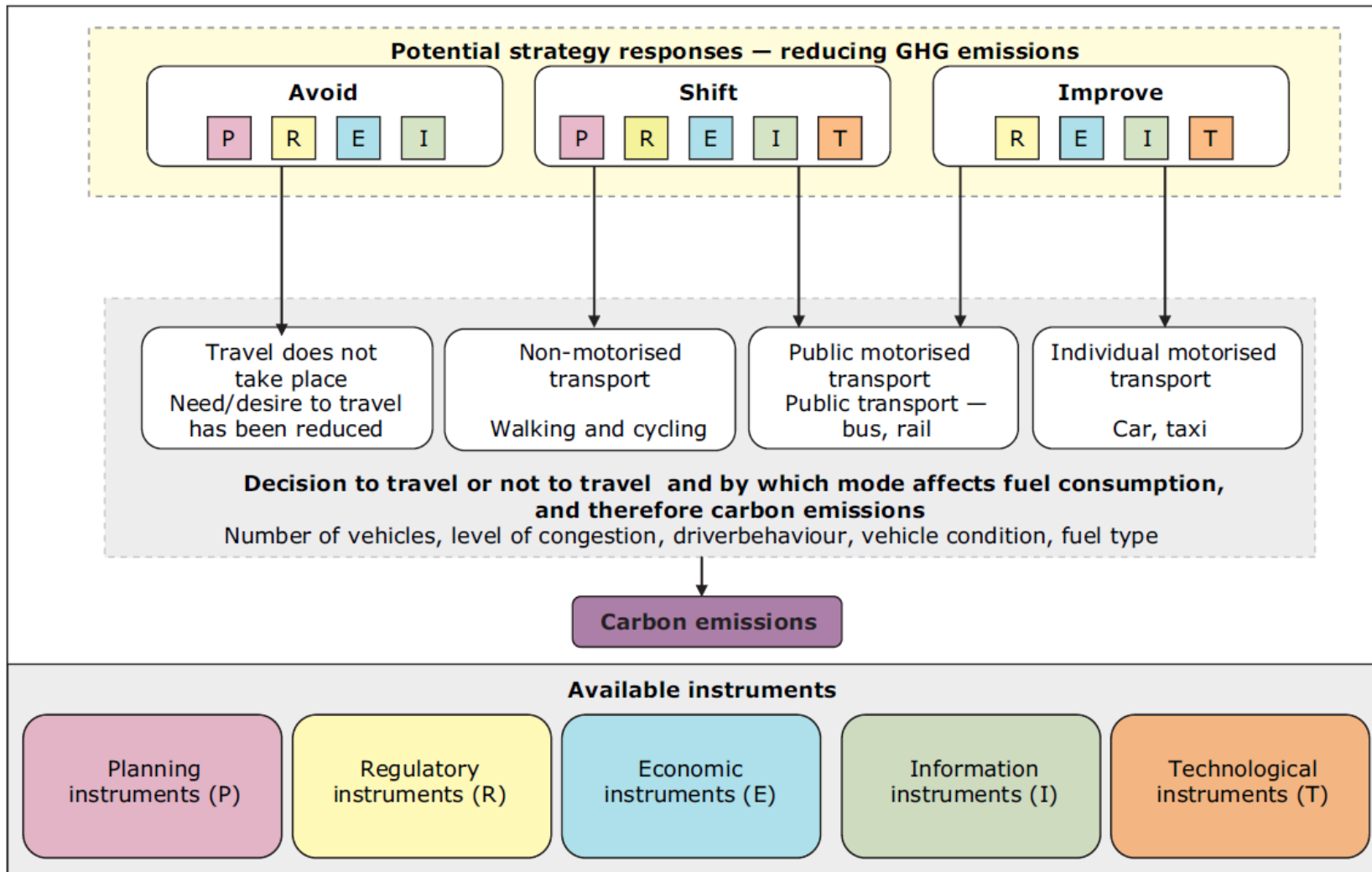
## Simpler definitions...

- “The ability to meet the needs of society to move freely, gain access, communicate, trade and establish relationships without sacrificing other essential human or ecological values today or in the future.”  
(World Business Council on Sustainable development 2004)‘
- “Sustainable transport is about finding ways to move people, goods and information in ways that reduce its impact on the environment, economy and society”  
(Ministry for the Environment, New Zealand, 2009)‘
- “Sustainable transportation – Transportation that promotes sustainable development”  
(Georgia Institute of Technology 2011)

# Selected impacts associated with transport

| Environmental   | Social   | Economic  |
|---|--|---|
| <ul style="list-style-type: none"> <li>• Air pollution</li> <li>• Noise pollution</li> <li>• Vibration</li> <li>• Light pollution</li> <li>• Visual intrusion</li> <li>• Water pollution</li> <br/> <li>• Consumption of land/urban sprawl</li> <li>• Release of toxic/hazardous substances</li> <li>• Solid waste</li> <li>• Disruption of ecosystems and habitats</li> <li>• Hydrologic impacts</li> <li>• Introduction of exotic species</li> <li>• Depletion of the ozone layer</li> <li>• Global climate change</li> </ul> | <ul style="list-style-type: none"> <li>• Mobility</li> <li>• Accessibility</li> <li>• Accidents</li> <li>• Obesity</li> <li>• Barriers for the disadvantaged</li> <li>• Inequalities associated with impacts</li> <br/> <li>• Community livability</li> <li>• Gender imbalances</li> <li>• Cohesion/integration</li> <li>• Opportunity</li> <li>• Anxiety/'Rootlessness'</li> <li>• Migration</li> </ul> | <ul style="list-style-type: none"> <li>• Costs of transport to customers/consumers</li> <li>• Time loss in traffic/ Congestion</li> <li>• Costs relating to accidents</li> <br/> <li>• Transportation facility construction, maintenance and disposal costs</li> <br/> <li>• Transportation-related health costs</li> <br/> <li>• Depletion of non-renewable resources and energy supplies</li> </ul> |

# Sustainable transport strategies



# 'Strategic' definition

## Sustainable Transport:

- support for quality public transport
- protected road space for buses, pedestrians, cyclists, public space
- rail or bus rapid transit organized in high demand corridors
- transit oriented development
- more equitable access for all
- high efficiency freight logistics

(Michael Replogle, ITDP 2011)



Michael Replogle  
Global Policy Director & Founder, ITDP

Presented to UN Commission on Sustainable  
Development Meeting, New York, December 15, 2011





# Issues in defining sustainability in transport

- Transport has **multiple and complex interactions** with society, is not a closed system by itself
- Transport has few '**natural**' mechanisms governing its sustainability
- No clear rule for **how much each sector** must contribute to meet overall sustainability objectives
- **Not given** that a transport option is always best or only solution

*"There is no such thing as a generally accepted definition of 'sustainable transport', and it is doubtful whether one would – or could – ever exist"*

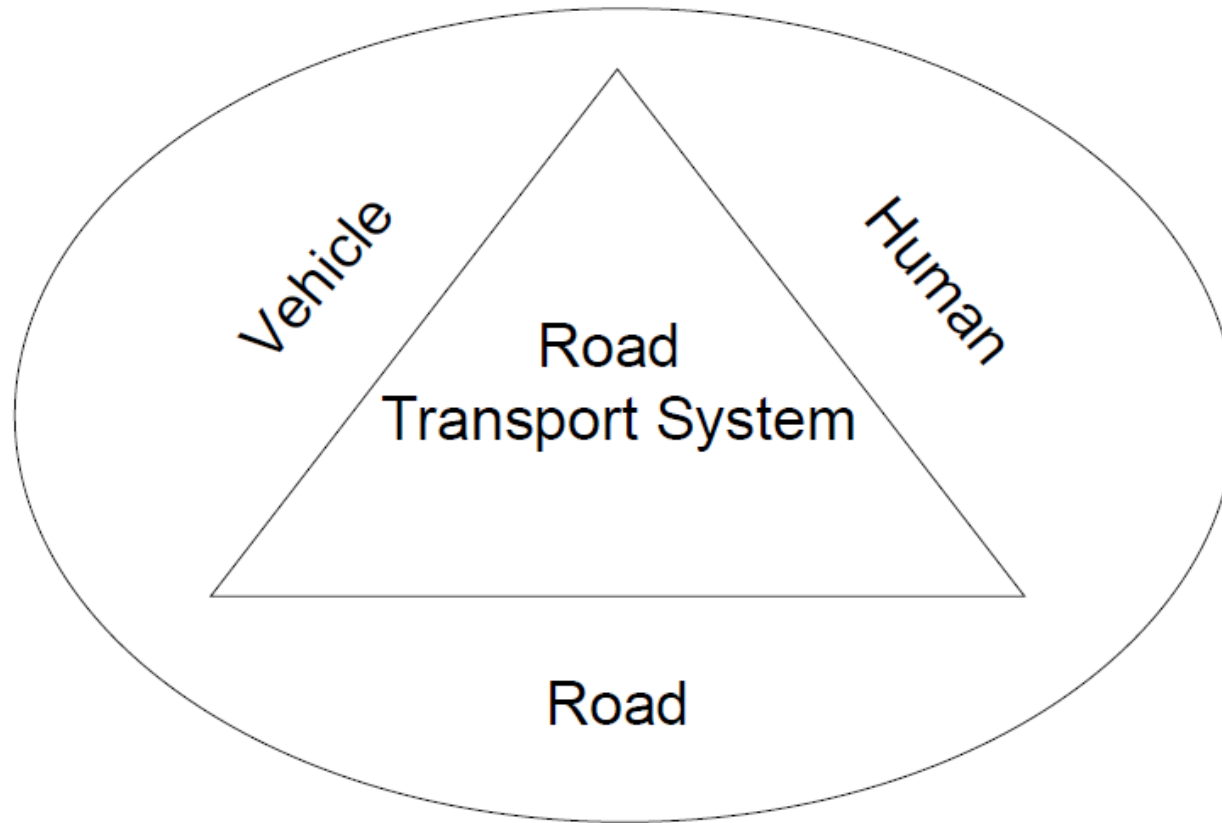
*(Peter Nijkamp et al 2004)*

## 4) Application to **NRA's**

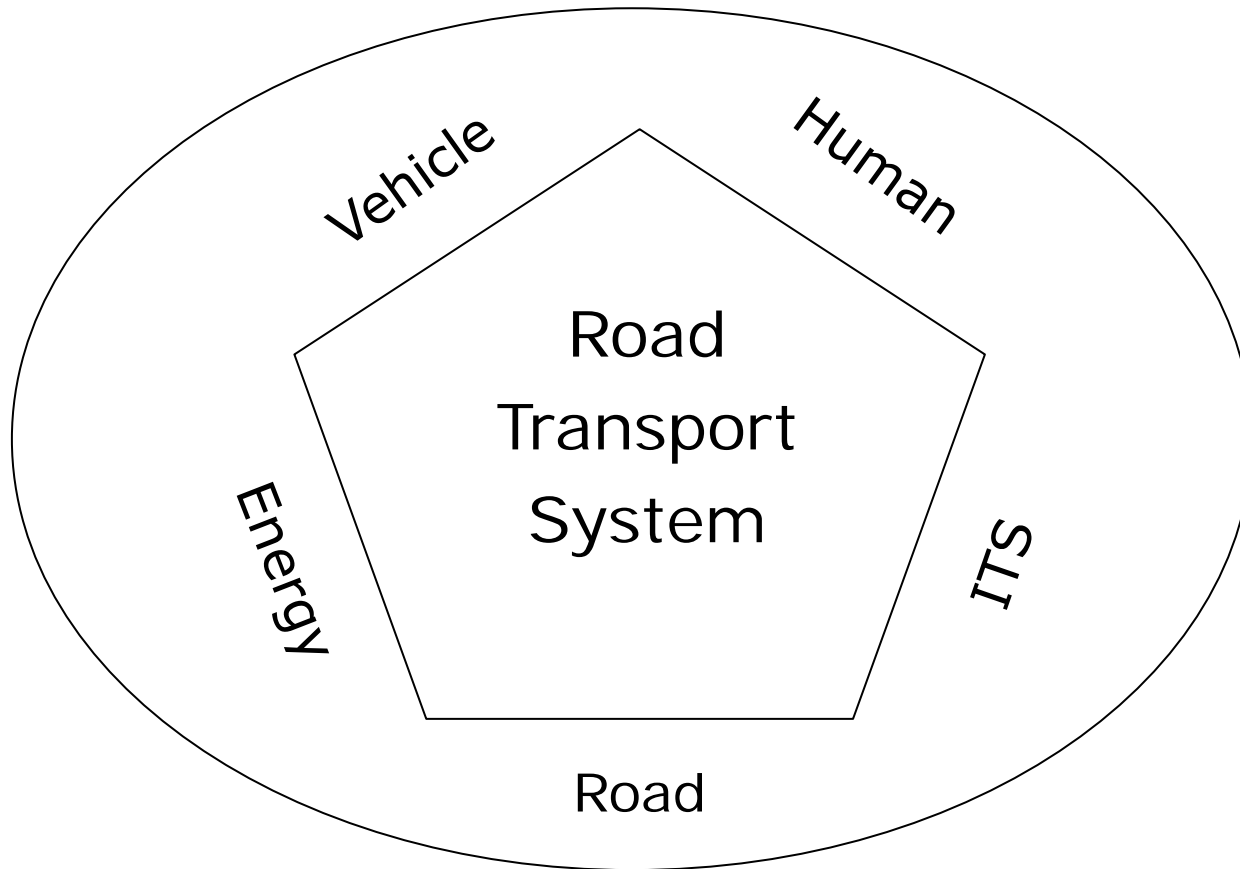
# NRA 'anatomy and context'

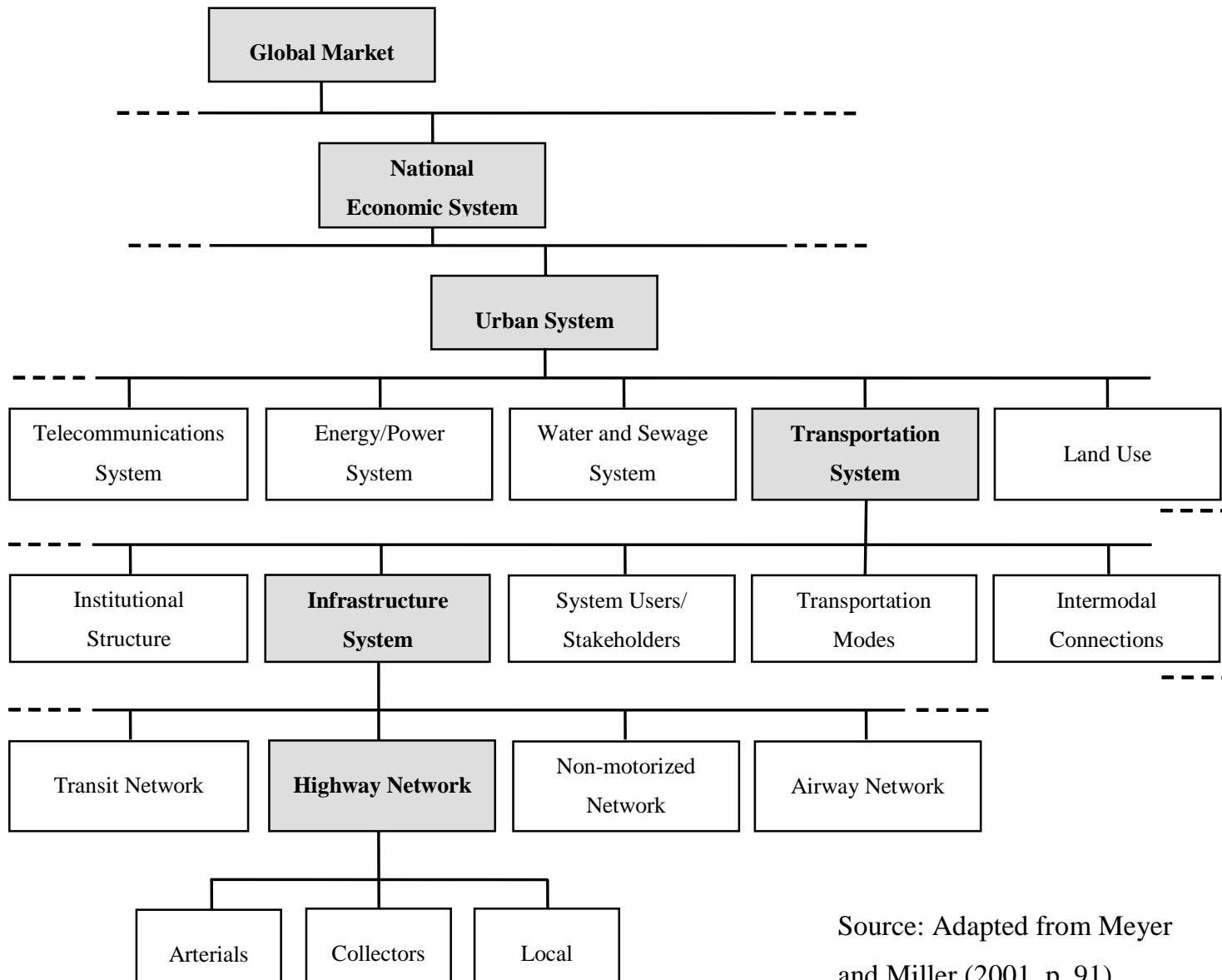
- Defining 'the road transport system'
- Defining an 'NRA'
- Application of sustainability definition to NRA's by,
  - Levels of activity
  - Goal Hierachry
  - Types of statements
  - Organizational units
- ....

# Road Transport system (OECD, 2001)



# Road Transport system (2012?)





Source: Adapted from Meyer and Miller (2001, p. 91).

### Life cycle analysis in automotive industry

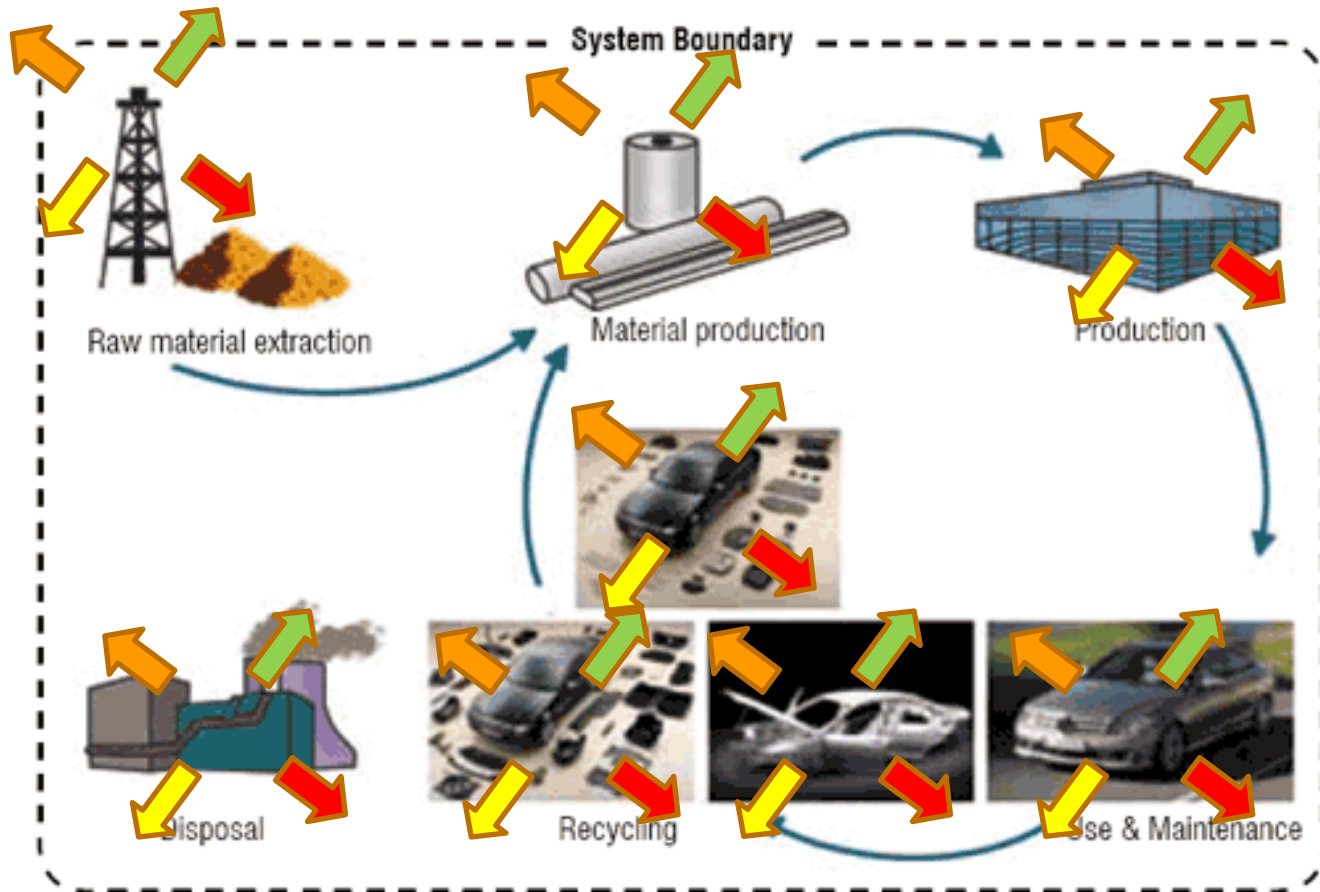


Figure 1

Source: adapted from <http://www.autofocusasia.com>

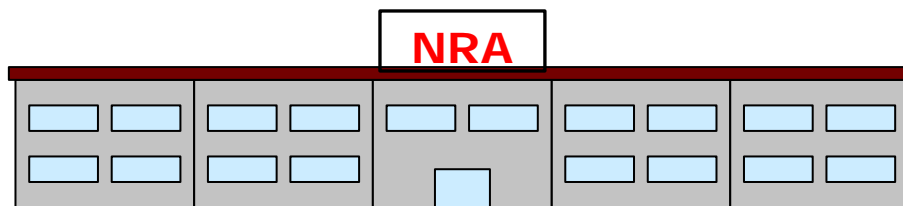
# What is an NRA? (1)

- A entity with responsibility to plan, design, procure, build, maintain, operate, and monitor road networks, and associated road transport system elements?

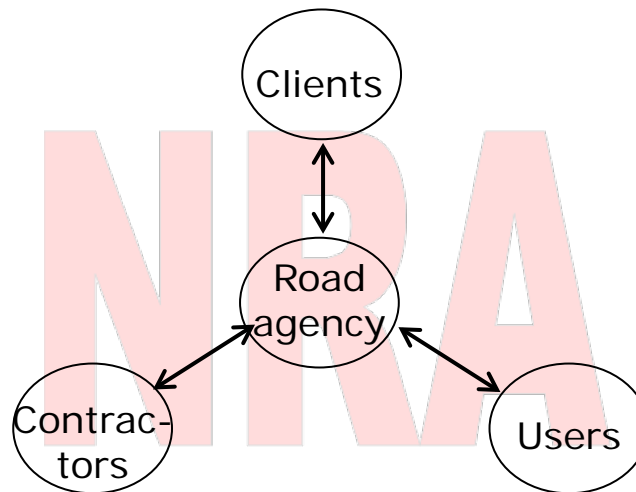


## What is an NRA? (2)

An **organizational** (or intra-organizational) view...



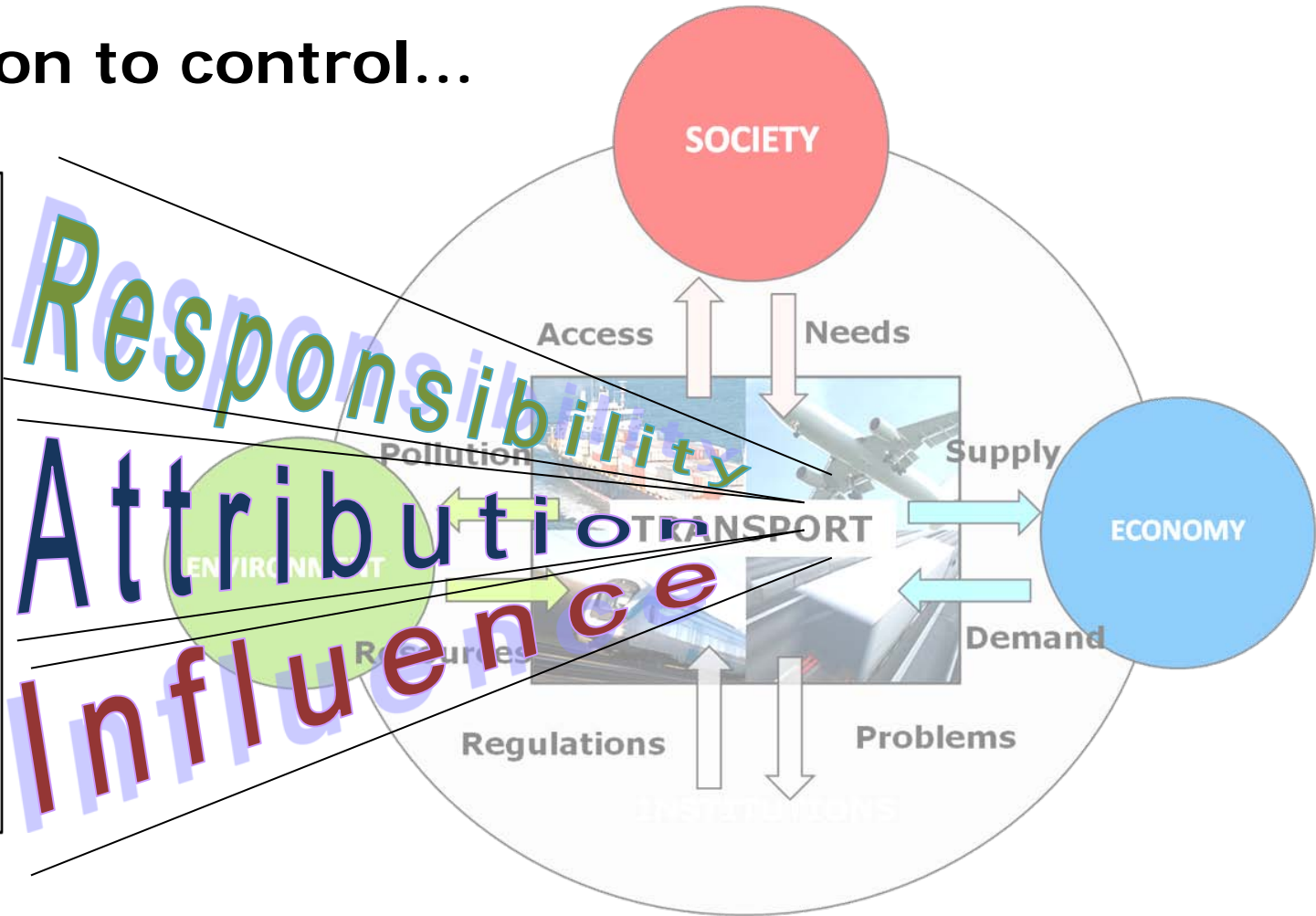
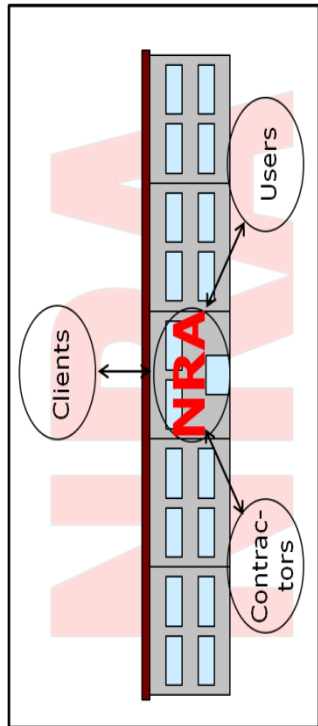
A **relational** (or inter-organizational) view



## What is an NRA? (3)

- Not all NRA's have same tasks/emphasis (devolution/outourcing)
- Not all NRA has the same clients (e.g Ministry of Transport, Ministry of Economy, Ministry of Sustainable Development)
- Not even all NRA's are NRA's only (e.g merge road/rail)

# Limitation to control...



# Adapting sustainability to levels of activity

## 'Policy and Planning'

- General policies
- Long term Planning
- Programming/decision making

Higher influence?

Limited knowledge?

## 'Delivery and operation'

- Design
- Procurement
- Construction
- Maintenance
- Measurement and Monitoring

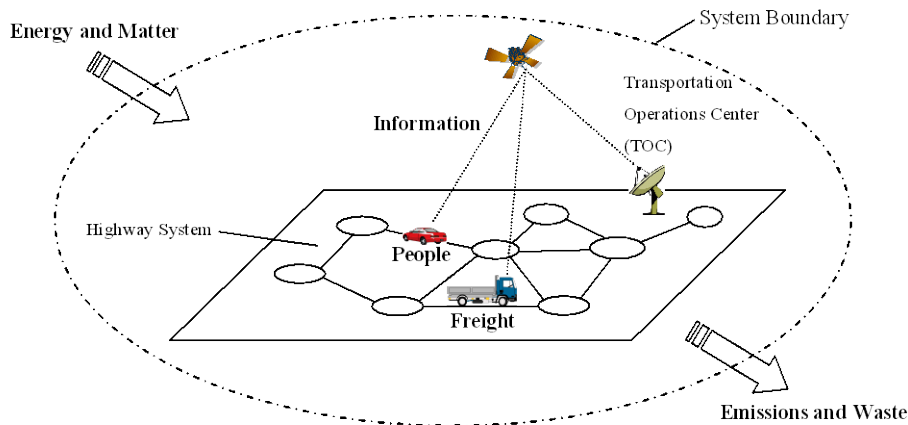
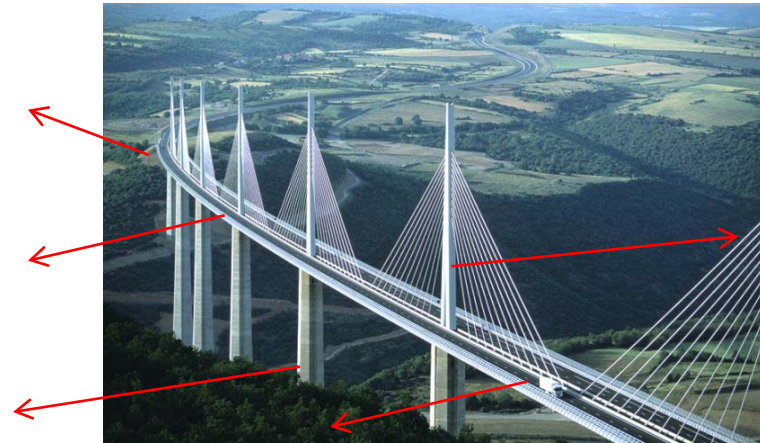
Limited influence?

Higher knowledge?



# Project level impacts

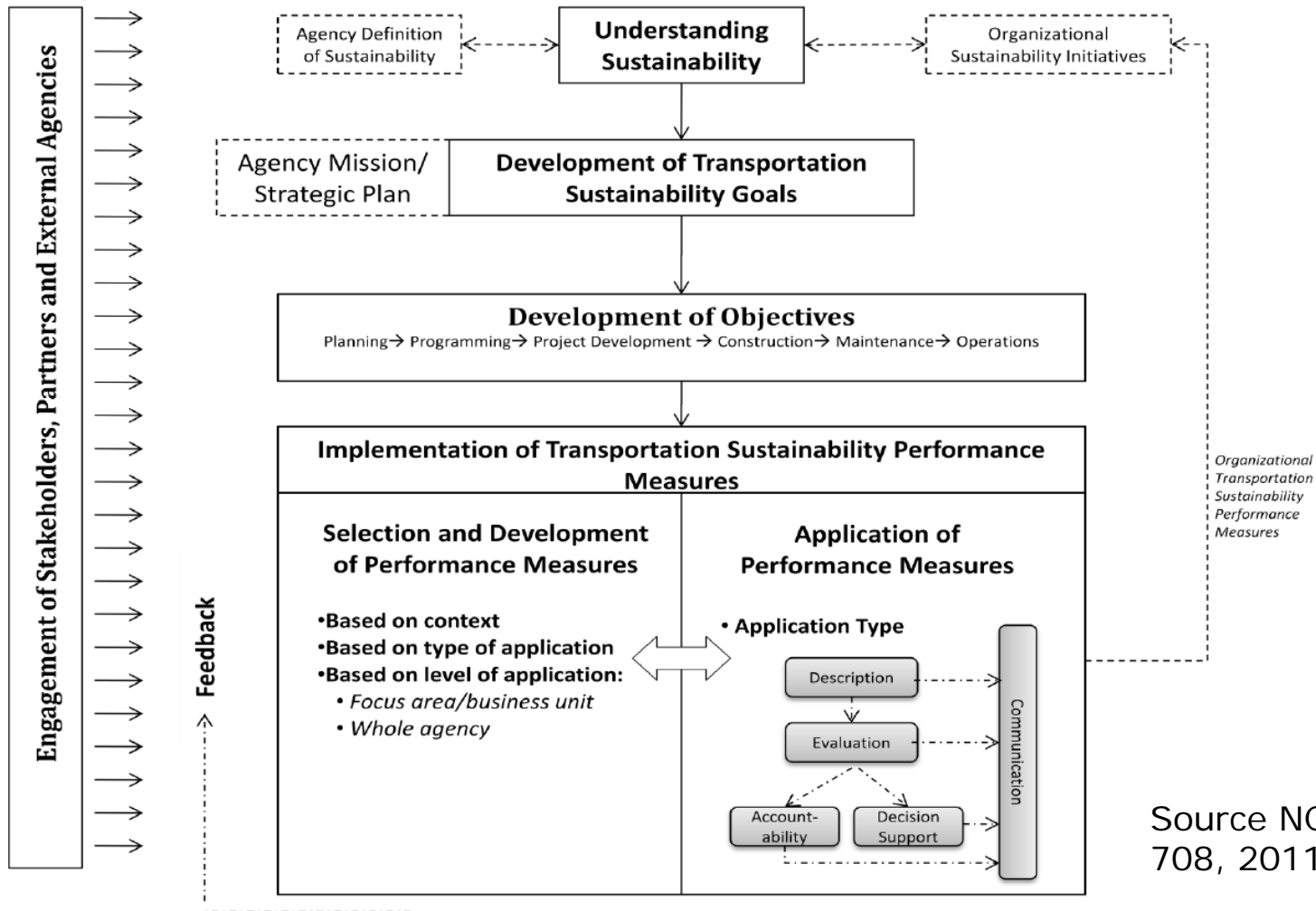
- Noise
- Landscape intrusion
- Aesthetics
- Air Quality
- Water flows
- Safety
- .....



## • System level impacts

- Total energy consumption
- Total Material requirement
- Total emissions and waste
- ...

# Adapting sustainability to goal hierarchy



Source NCHRP Report 708, 2011

# Adapting sustainability to statements

- **Visions** for a sustainable transport system
- **Mission** for the NRA
- NRA core **values**

## UK - 'A sustainable Highways Agency'

"To make sustainability inform our business, we will embed it into our operations and contribute to a sustainable transport system. To add value we:

- Aim to contribute to social, environmental and economic objectives for the wider benefit of society.
- Reduce negative impacts associated with our network.
- Play a leading role in a sustainable future.
- Ensure we meet our spending review obligations"





## Summary: An effective framework for defining sustainability strategies...

- Includes a comprehensive understanding of sustainability principles and outcomes
- Has a good connection to the goals and objectives of an agency/community
- Supports vertical and horizontal integration in the agency/community
- Captures the interactions among variables
- Reflects stakeholder perspectives
- Considers the capabilities and constraints of an agency/community, and
- Is flexible to foster self-learning

(Adapted from Pei et al 2010)

## **Pros and Cons of definitions (NCHRP 708, 2011)**

### **Advantages of an explicit definition of sustainability,**

- Help agency familiarize itself with and gain ownership of the concept of sustainability,
- Identify and pinpoint where its main concerns lie
- Communicate internally and externally about how sustainability is a priority to the agency.

### **Disadvantages of an explicit definition**

- A definition of sustainability can be abstract and of little use without further application
- May create illusion that transportation is a closed system that is sustainable in itself
- A short, simple definition may omit essential principles and aspects of sustainability for ease of communication

## 5) **Discussion:** How to define sustainability for NRAs` ?

# At what level should a definition be adopted?

1. **General definition of Sustainability/SD**
2. Definition of a **sustainable transport system**
3. Definition of a **sustainable road transport system**
4. Definition of a **sustainable NRA**

# In what 'manifestation' of an NRA should it adopt a sustainability definition?

- **Organizational** view?
- **Relational** view?
- Levels of **activity**?
- **Goal hierachy**?
- **Key statements**?
- Organizational **units**?

## Questions (2)

- What should the SUNRA framework emphasize:
  - 1) A list of existing overall sustainability definitions that NRAs could choose?
  - 2) A list of speculative definitions that NRAs could consider?
  - 3) A critical examination of existing definitions?
  - 4) Examples of definitions applied to various levels/functions of NRAs? (vision/ mission/values/ goals/activities)
  - 5) A step-by-step guide for setting up definitions?
  - 6) Other

# Criteria for NRA sustainability definitions

## Content related

- Ensure consideration of key principles and dimensions of sustainability

## Context related