Chapter 1

The challenge: sustainable road transport

The transportation of goods and passengers is increasing world-wide. A large share of this transport can be attributed to motor vehicles which often have serious impacts on human health, environmental quality, urban development patterns, road conditions, and road safety. Increasingly, developed and developing countries are seeking strategies to guarantee individual mobility, and at the same time trying to improve ecological and social conditions. Sustainability is increasingly adopted as a framework for designing and implementing such strategies. Due to their predominant role, road transport issues are of particular concern. For a "sustainability approach" to road transport a number of questions must be addressed:

- What is "sustainable road transport"?
- What are the policy options within a sustainable strategy?
- Which role do Economic Instruments play in such a strategy? In particular: When should they be used? What are their limitations? How can Economic Instruments contribute to sustainable road transport? What types of Economic Instruments are there?

Chapter 1 discusses these questions and outlines the concepts involved in a strategy for sustainable road transport, the goals that can be achieved and the role of Economic Instruments in such an approach.

What is "sustainable road transport"?

"Meeting the needs of present and future generations."

Strategies for sustainable road transport can easily be derived from the broader concept of sustainability. Generally speaking, sustainable development implies meeting the needs of the present generations without compromising the ability of future generations to meet their own needs (WCED 1987). This entails three dimensions:

Sustainability covers economic, environmental and social aspects.

- **economic sustainability (economic efficiency):** although public debate about sustainability often focuses on ecological goals, in fact, a sustainable development cannot be achieved unless the effects on the economy, employment and the provision of goods are considered;
- **environmental sustainability (ecological stability):** this requires that the environmental balance is not overburdened by human emissions and resource use in order to guarantee the functional stability of present eco-systems, both on a local and global scale;
- **social sustainability (distributional/social equity):** social and distributional needs are met by ensuring a fair distribution of resources, poverty reduction, stable human development, public participation, and democratic policy formation.

For the transport sector, sustainability can be specified.

Still, this general approach has to be further broken down in the transport sector, and adapted to the specific needs of developing countries. Table 1.1 summarises a number of possible policy objectives for road

Table 1.1: **Why support sustainable mobility?** Sources: UN ESCAP 2000; Cracknell 2000

Economic goals	Ecological goals	Social goals
- Provide infrastructure for sound economic development and employment - Allow for cheap, fast and high-volume transport - Reduce congestion - Strengthen rural-urban interlinkages - Create sound financial basis for public transport - Allow for different transport options - Raise revenue for infrastructure and transport facilities set-up, operation and maintenance	- Improve health and safety in transport - Reduce pollution on local, regional and global level; contribute to climate stabilisation - Reduce land take - Integrate environmental and economic dimensions in transport planning and development - Develop an environmentally sensitive strategic framework	- Guarantee transport services and access for all social groups - Focus on transport for the (urban) poor - Improve methods of addressing transport problems of the poor - Protect poor against adverse changes in transport policies - Ensure democratic participation in transport policy decision-making

transport as found in practice and in literature. If the concept of sustainability is taken seriously, all three dimensions have to be considered simultaneously. It quickly becomes clear that selective measures will not be sufficient. A sustainable transport strategy requires a comprehensive and well-balanced set of measures to address the wide range of goals; furthermore, sustainability must incorporate a long-term view.

Further information about Sustainable Transport, including general issues and the theoretical background, as it is presented in this and the subsequent sections can be found in UN ESCAP 2001. Also see Cracknell 2000 for urban transport issues, and OECD 2001 for a break-down of goals into various transport demand management strategies.

What are the costs of transport?

Costs play a central role in any sustainable transport policy.

To pursue sustainable development, costs play a central role in determining transport policy. Basically, two major categories of costs have to be distinguished:

Internal costs stem from the provision (construction, maintenance) and use of transport infrastructure. These costs have to be recovered from infrastructure users or from the public. Internal costs are the basis for all decisions on the transport market. They largely determine both individual mobility demand, and transport supply via rentability decisions of transport providers or calculations on the economic feasibility of infrastructure projects, etc.

External costs, on the other hand, are not part of supply or demand decisions on the transport market. They are external to these decisions. They stem from (mostly negative) side-effects of transportation, such as congestion, accidents, emissions and pollution, noise, and aesthetic factors which all negatively affect people and/or future generations. They are rarely borne by road users. Even countries that have implemented the "user pays principle" (every transport user pays for all costs he/she incurs), basically apply it to internal costs only, and do nt factor in the external ones. As a consequence, road transport is too cheap and its use inefficient. This results in negative environmental and social effects that would be less severe if external costs were borne by road users as well.

Therefore, it is important to

- **make internal costs internal.** In many countries internal costs of transport are not yet borne by road users. Transport investment is often provided free of charge and paid for from the general budget.

Road users should pay for both internal costs ...

When state revenues from the transport sector are lower than investment in the sector then the transport sector is subsidised out of the general budget. Road users do not pay the full costs they cause.

... and external costs.

- **make external costs internal.** With proper accounting in place, internal costs may be determinable, but external costs are extremely difficult to measure. Thus, any attempt to make road users pay exactly for the costs they cause is an illusion. Nonetheless, according to various empirical studies and experience from all over the world, external costs of transport are significant; even with high charges on vehicles, fuel, road use etc., external costs

Table 1.2: **Internal and external costs of road transport, and selected policy options** (Note:Options marked with an asterisk are Economic Instruments)

Cost component	**Policy Option** (selection)
1. Internal costs	
- infrastructure construction and maintenance (variable and fixed costs)	use-charges fixed charges public procurement
- transport equipment construction and maintenance	
2. External costs	
- congestion	- congestion charges - parking fees - traffic management
- accidents (material, persons, animals)	- road safety policy (standards, traffic management, education) - risk-related insurance premiums (= specific user-charges)
- emissions/pollution (air, water, soil, climate change, acid rain etc.)	- environmental standards (vehicles, fuels) - traffic management (e.g. speed limits) - use-charges - specific urban measures (e.g. parking policy, restricted access)
- noise nuisance	- standards - use-charges - planning policy
- visual intrusion - ecosystem fragmentation - etc.	- landscape and city planning

are still far from internalised. The risk of overestimating internalisation requirements is low.

Sensitive internalisation approaches will not seek to achieve full-cost pricing immediately. Price hikes would be too extreme to be economically sustainable. Adjustment of market structures, transport use, behaviour, technologies and supply/demand patterns needs time. This time must be reflected by sound long-term strategies. Internalisation (both of internal and external costs) is an indispensable element of sustainable transport, but it must be achieved step-wise not shock-wise. Only then will it have a greater chance of being accepted by all market participants and gain sufficient political support. Table 1.2 summarises major types of internal and external costs, and provides some policy options to mitigate their consequences.

Though an exact internalisation of costs is an illusion, the general direction is clear: road transport is currently too cheap.

What are the policy options?

There are basically four different elements in a sustainable transport strategy:

There are four types of instruments: regulation, cooperation, economic incentives and information.

- **Regulatory and Planning Instruments:** The regulatory approach administratively sets standards, restrictions, administrative procedures, etc.. Regulatory Instruments basically follow a command-and-control approach.

- **Cooperation Agreements:** Cooperative approaches try to get all the people engaged in a specific issue involved in a process of voluntary communication and negotiation. The aim is to reach a consensus on policy goals and to design voluntary measures to reach these goals. Cooperative solutions can be found in various forms, including all kinds of negotiations between states and/or private entities.

- **Economic Instruments:** Market-based approaches use economic incentives and/or disincentives to pursue a policy goal. The price mechanism serves as a vehicle for policy enforcement. By changing the price of private transport supply and demand, the decisions of the users and providers can be guided into more favourable directions. Two basic instruments exist:

  – **Price instruments** have an immediate influence on prices, e.g. by imposing a tax on specific goods;

– **Quantity instruments** restrict the availability of a good and leave the formation of prices to the market. Auctions and bidding schemes are examples of quantity instruments in effect.

- **Information Instruments:** Information about transport issues can serve as a basis for more rational transport decisions of transport users and suppliers. The choice of transport modes, the acceptance of policy measures and the use of vehicles can be improved through moral suasion and transport-related education. Information instruments include public awareness campaigns, public information procurement and public acceptance monitoring.

Table 1.3: **Selected transport policy measures**

Regulatory and Planning Instruments	Cooperation Agreements	Economic Instruments
- standards for production, processes, emissions, noise, road safety, haulage etc. - restrictions on market access (e.g. public transport) - concessioning regulation (taxis, public transport etc.) - administrative procedures for infrastructure planning, public procurement, road maintenance - traffic regulation, drivers' education - physical measures (pedestrian zones, route-area controls, road space reallocation) - infrastructure planning - regional development and land-use planning	**Between state and private entities:** - public private partnerships - "voluntary" reduction agreements - eco-labelling, ISO 14000, road safety schemes **Between states:** - international agreements on infrastructure set-up, use, regulation - bilateral / multilateral cooperation - administrative cooperation of regulatory bodies and authorities **Between private entities:** - Cooperative Approaches between non-governmental organizations and enterprises - compensation agreements (joint implementation of measures etc.) - cooperation on technical standards and procedures, R&D cooperations	**Price instruments:** - taxes/charges on purchase, use, sales and/or scrappage of vehicles, fuels, etc. - taxes/charges on transportation access, transport market access, infrastructure use, etc. - modal subsidies (with similarly diverse applications as taxes) - price differentiations in various forms (type of engine, type of fuel, transportation mode, time of day, type of road, etc.) **Quantity instruments:** - certificates of entitlement - tradable (pollution) permits - auctions (e.g. for vehicle licences) - bidding schemes (e.g. franchise bidding for operators)

Table 1.3 gives some examples of Regulatory Instruments, Cooperative Agreements and Economic Instruments. Traditionally, Regulatory Instruments play a major role in the transport sector. Most countries firmly regulate the provision and use of transport infrastructure and services. For instance, road safety can best be enhanced by issuing a set of rules and standards for vehicle design, driving conduct, inspection and maintenance, etc. For environmental protection, many countries have introduced emission standards and safety regulations for the transport of dangerous goods, such as gasoline.

Increasingly, however, policy makers are supplementing the use of Regulatory Instruments with Cooperative Agreements and Economic Instruments; these instruments allow them more flexibility in their pursuit of sustainability and are more efficient. In particular, direct price instruments, such as taxes and charges, are becoming a major policy focus. However, quantity instruments such as auctions are also being applied, as is the case with the Singapore Vehicle Quota Systems (see Chapter 4).

How can Economic Instruments contribute to sustainable road transport?

In general, a sustainable road transport policy contributes to three types of (hardly separable) policy objectives:

- the use of economic mechanisms to pursue environmental, social and economic development goals such as
  - **outcome objectives**, i.e. specific quantitative goals for transport mode patterns, reductions of emissions, air and water quality, road safety, accident reduction, etc., and/or
  - **activity objectives**, i.e. induce specific economic/ environmental/ social behaviour, environmental awareness, raise environmental and social sensitivity in individual and public decisions, etc.
- the recovery of costs of transport, and/or
- the creation of additional revenue to finance public expenditures.

There are no specific measures attributable to each of these goals.

Rather, many transport policy measures can be used to pursue all of these goals at the same time. For revenue creation, Economic Instruments – such as taxes and charges – are indispensable. The scope of charged transport-activities and the revenue raised vary considerably depending on the specific Economic Instrument used.

Furthermore, it should be borne in mind that each revenue-oriented measure influences transport behaviour, demand and supply patterns. People will try to avoid and reduce levies by changing transport modes, technologies, times and routes. In order to achieve sustainable development these collateral effects should be anticipated and taken into account when designing and implementing transport measures. Otherwise, economic, social and/or environmental policy objectives may not be attained.

Which types of Economic Instruments exist?

There are three basic types of Economic Instruments in transport policy.

In the transport sector, there are various possible Economic Instruments. The main categories are as follows:

- **Charges and taxes** aim at increasing the price of transportation per unit or value of transport use. They should be levied as a means to reduce transport demand in general, discourage the use of certain modes of transport, or certain transport technologies. Charges are normally directly linked to the public provision of services (such as road use charge, parking fees, etc.), whereas taxes do not have this direct link to any particular service. Rather, they are seen as specific sources for the general budget.

- **Subsidies** aim at decreasing the cost of certain transport modes, such as public transport or multimodal transport. Here, financial incentives shall encourage switching towards the favoured transport patterns. It would be counterproductive, however, to subsidise fuels for private motorised transport and public transport at the same time.

- **Auctions and bidding schemes** are used to put a price on transport in a regime that quantitatively restricts access to transport. E.g. – as in the case of Singapore (see Chapter 4) – when the number of cars is administratively restricted, auctioning can assign licenses or certificates to those market participants with the highest willin-

gness to pay. In the case of bidding schemes in public transport, operators can bid for a concession to operate a particular part of a network.

Table 1.4:
Survey of economic incentive measures

Type of incentive or disincentive	Possible Economic Instrument(s)	Selected Economic Measure(s)
- Discourage motorized vehicle ownership	- tax/charge on vehicle purchase/ownership/ scrappage	- annual vehicle tax - registration tax/charge - (re)sales tax/charge - scrappage tax/charge
	- restricting the number of vehicles and/or new registrations	- auction schemes competitive bidding for new licenses - licensing car ownership
- Discourage motorized vehicle use - Encourage switch to public or non-motorized transport	- tax/charge on vehicle use	- fuel tax - pay-at-the-pump (sur)charges - tax on vehicle miles traveled (VMT fees)
	- tax/charge on road and/or infrastructure use, - restricting access to urban centres or special areas	- parking fees - city tolls - road pricing - bridge tolls - cordon pricing - congestion pricing
	- subsidies for public transport and/or multimodal transport (modal subsidies)	- subsidised public transport fees - subsidies for public transport networks and operation - tax-deductable public transport expenses - P&R schemes
- Encourage lower emission technology use and innovation	- taxes/charges on vehicle purchase/ownership/ scrappage, - taxes/charges on vehicle use, - taxes/charges on road and/or infrastructure use	- tax differentiations based on emissions - carbon/energy taxes - emission fees - emission-based surcharges - subsidies, tax rebates for low emission vehicles/technologies

These basic types of Economic Instruments can be applied in various forms and ways. Table 1.4 provides a survey of the most important incentives/disincentives and different possible Economic Instruments to implement these incentives. The right hand column gives some examples of measures that can be applied. Many of these measures will be discussed in more detail in the subsequent chapters. Subsidies may be a pragmatic second best solution when measures such as road pricing are not feasible.

Why should Economic Instruments be used?

Economic Instruments have many advantages.

Economic Instruments are characterised by their use of market forces, i.e. the price mechanism, to achieve policy objectives. There are two groups of Economic Instruments: price instruments (such as taxes, charges and subsidies) and quantity instruments (such as permits or certificates). The use of market forces to influence transport demand and supply is what makes Economic Instruments advantageous in the pursuit of a sustainable transport policy:

- **Revenue generation.** Price instruments usually generate additional revenues. In many countries fuel and vehicle taxes play a major role for state funding and financing of transport policy programmes.

- **Market-economy compatibility.** By using the price mechanism as a vehicle for cost internalisation, market allocation processes are not distorted.

- **Enforcing the user-pays-principle.** By charging for the use of infrastructure and vehicles, only transport users pay for the costs of their mobility. These costs include infrastructure set-up, maintenance, environmental damage, etc.

- **Incentive-based transport policy approach.** As part of demand side management, Economic Instruments can contribute towards reducing transport demand, change the modal split by inducing substitution (e.g. in favour of public transport) and change transport behaviour. On the supply side, Economic Instruments can enable fair competition among the transport modes and induce incentives for technical change and higher efficiency of vehicles.

- **High effectiveness.** By using price information, the "user pays principle" can be reached efficiently. Economic Instruments leave room for individual optimisation, and thus allow for cost-minimising transportation.

- **Dynamic incentives.** Economic Instruments can set dynamic incentives for substitution, technical change and the research and development of pollution abatement technologies.

- **Greater flexibility.** In general, Economic Instruments offer more flexibility than Regulatory Instruments as individuals and firms can more flexibly adapt to economic incentives than to administratively set restrictions.

What are the limits to Economic Instruments?

However, there are some limits to the use of Economic Instruments as well.

Despite the advantages given above, there are several draw-backs that possibly reduce the degree of implementation of Economic Instruments:

- **Uncertainty about the right level of levies.** Correct prices require information about the level of internal and external costs. Due to valuation problems this information may not be adequately obtained, thus making it difficult to set levies at the "right" level. Furthermore, policy objectives can only be reached indirectly as Economic Instruments only set up a framework within which each individual makes his or her own decision. Such market reactions cannot be predicted correctly, hence the use of Economic Instruments may require several readjustments in order to reach a certain policy objective.

- **Uncertainty about the reaction lags.** Reaction times of market participants may be long. Increases in fuel prices, for instance, show only little reductions in fuel demand (so-called small elasticities) in the short run, but greater elasticities in the long run (cf. Oum et al. 1990).

- **Unpredictable and unstable revenues.** Despite their large potential to create revenue, Economic Instruments may sometimes be a shaky basis for revenue generation. This is particularly the case with environmentally motivated price increases, which trigger substitution, technical change and a reduction of environmental use. This successful decrease in environmental use will thus correspond to a decrease in revenue.

- **Competitive disadvantage.** The use and intensity of Economic Instruments differ nationally and internationally. This may result in competitive disadvantages for countries, regions and cities with strong transport levies.

Economic Instruments can only form a part, though an important one, in a sustainable transport strategy.

Taking the above concerns into account, Economic Instruments should always be embedded in a broader policy strategy for sustainable transport. This strategy should include other types of instruments for short-run steering, the averting of risks and dangers, international transport policy cooperation, and revenue generation. Table 1.5 summarises the main decision criteria when to use and when to avoid Economic Instruments.

Contrary to some economists' belief, Economic Instruments merely provide one of the building blocks towards sustainable development. Unless this block is neatly fit into the overall framework of a comprehensive sustainable transport strategy, transport policy may fail. It is only within a sustainable transport framework that Economic Instruments can play a crucial role in achieving economic, social and ecological goals simultaneously.

Thus, while focusing on Economic Instruments, in the next chapters it must be borne in mind that the measures discussed always have to be regarded as being just part of a greater sustainable transport strategy which at the minimum includes other measure as listed in the "strategy tree" in Figure 1.1.

With these blocks in place, a sustainable transport strategy may indeed allow for the foundation of a sustainable development of transport structures and volumes. The next step, certainly, is to specify the different strategy elements.

Table 1.5: **Decision criteria for Economic Instruments**

Economic Instruments should be implemented ...	Economic Instruments should <u>not</u> be implemented ...
- to improve economic efficiency of the transport system; - to set economic incentives for technical change/development; - to raise start-up capital for public transportation; - always in the form of a medium- to long-term policy measure; - step-wise (not shock-wise) and readjusted foreseeably and frequently;	- in areas with pressing environmental damage and health risk; - as the sole type of transport instruments; - for short-run policy objectives that require quick transport demand and supply changes; - as the sole source of public revenues; - without safeguard-measures that prevent loss of competitiveness; - when enforcement is unlikely due to strong public resistance and very limited institutional capacities.

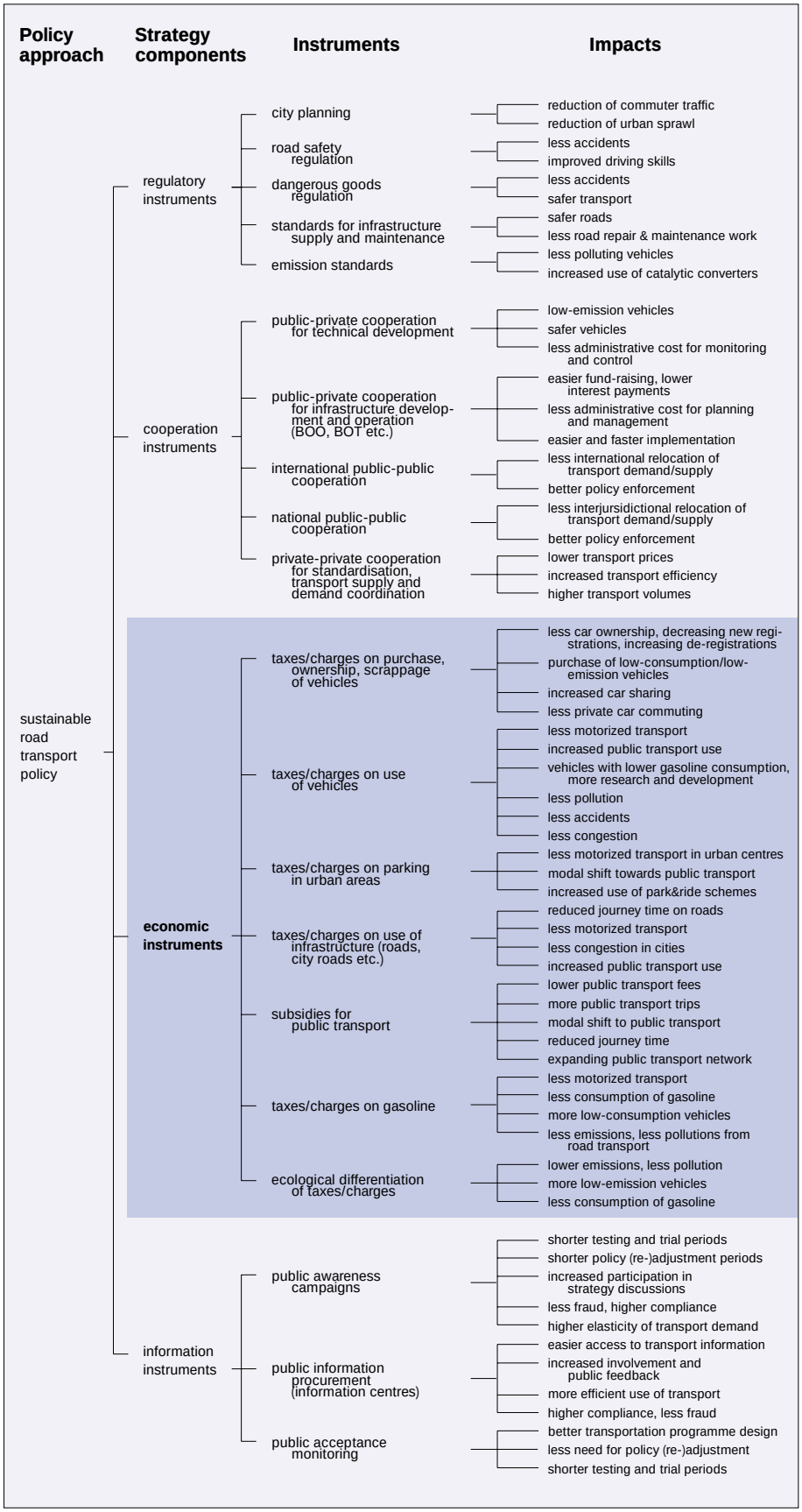

Figure 1.1:
Strategy tree for a sustainable road transport policy