# Decision making processes and their interaction with transport energy consumption: A comparison between Europe and South-East-Asia

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## Keywords
decision making process, energy consumption, Europe, South-East Asia, land use and transport interaction modelling

## Abstract
The worldwide ongoing trend of urbanisation enables the economic growth necessary for globalisation. On the other hand densification in population combined with increasing economic activities and motorisation causes significant negative impacts in terms of non-renewable energy consumption as well as quality of life for the metropolitan population. In this area of conflict, planning of transport systems is of increased importance, particularly in the context of the overall development of urban regions. It is important to understand how decision-making processes work and to design guidelines for helping such processes. In the recently finished EU-funded project PROSPECTS the decision making processes of European urban regions were analysed and an "ideal" decision making process was identified. A "Decision Makers Guidebook" was the major project result. In a further EU-funded project, SPARKLE, the transferability of this "ideal" process to South-East-Asia was put under scrutiny, through seminars and workshops in Thailand, Viet Nam, Cambodia and Laos. The land use and transport interaction model MARS was used in these seminars to simulate the effects of decision making on transport energy consumption. In this paper we firstly introduce the "ideal" decision making process published in the Decision Makers Guidebook. In a second step we report on what we have learned from participants attending the workshops in South-East Asia and summarise the experiences on transferability of the "ideal" process, highlighting differences between Europe and South-East Asia. Thirdly we analyse the interaction between decision making processes and transport energy consumption. This section includes a brief case study of Hanoi employing a System Dynamics model. Finally we summarise our findings and draw some conclusions.

## Introduction
The worldwide ongoing trend of urbanisation supports the economic growth is associated with the current phase of globalisation. However, the resulting densification in population and increase in (urban) economic activity can lead to significant negative "quality of life" effects if combined with an inadequate transport system, in particular a transport system which is biased towards private vehicles.

In this area of conflict, the planning of transport systems (in the context of the overall development of urban regions) is of increased significance. Furthermore, it is important to understand the functioning of decision-making processes with respect to transport planning, and to design guidelines for helping such processes.

The recently finished EU-funded project PROSPECTS (Procedures for Recommending Optimal Sustainable Planning of European City Transport Systems) investigated the decision-making processes for urban transport and land use planning, and identified an "ideal" decision-making process for sustainable transport planning in the European context. This process, which incorporated results from a number of previous EU research projects, was described in detail in a "Decision Makers Guidebook" (DMG) (May et al., 2005). The DMG was designed to help all those involved in decisions on land use and transport, in cities throughout Europe, whether as politicians, professional advisers, stakeholders or individual citizens.

The DMG is supported by two other guidebooks: a Methodological Guidebook (Minken et al., 2003) which explains how a particular option can be implemented, and a Policy Guidebook (ITS, 2002) which explains how particular policy instruments operate, based on real life experience. All three Guidebooks are available for free on the internet or as a paper copy (the web addresses are provided in the Bibliography below).

In a further EU-funded project, SPARKLE (Sustainability Planning for Asian Cities making use of Research, Know-How and Lessons from Europe), the transferability of this "ideal" process to South East Asia was put under scrutiny, through two seminars (in Bangkok and Hanoi) and eight intensive participatory workshops in Thailand, Viet Nam, Cambodia and Laos. Each seminar was attended by more than 200 decision makers and their advisers, and each workshop had between 20-30 participants. The DMG was introduced in both seminars and workshops, with the latter focusing upon how the DMG might be applied "locally". The feedback gained from these activities was positive and encouraging, although it was recognised that there were some significant differences as to how the DMG approach might be applied in a South East Asian context.

For the workshops in Thailand and Viet Nam, participants had the opportunity to work interactively with a state-of-the art Land Use and Transport Interaction (LUTI) model MARS (Pfaffenbichler, 2003), and were able to see the predicted outcomes, with respect to goal fulfilment, of both single policy instruments and combinations of instruments. A state of the art energy consumption and atmospheric emission model was added to MARS within the EU-funded project STEPS (**S**cenarios for the **T**ransport system and the **E**nergy supply and their **P**otential effect**S**). The opportunity to combine individual instruments to form strategies allowed them to explore synergetic effects of such combinations, and helped their understanding of the complex dynamic interactions between land use and transport systems.

This paper provides some insights gained from these activities, and is structured as follows. First, we introduce a classification of different decision-making processes identified in Europe, and describe in more detail the so-called "ideal process" developed for use in Europe. Next, we discuss general issues of transferability of such a process to South East Asia and we highlight necessary adaptations of the process to fit the South East Asian context (focussing particularly upon the four South East Asian countries involved in SPARKLE). In the following section we identify links and interactions between decision making processes and transport energy consumption. The results of the paper are summarised and discussed in the final section.

## Decision-making processes, as identified in Europe

### APPROACHES TO DECISION MAKING

The DMG (May et al., 2005) identified three broad approaches to decision-making: vision-led; plan-led; and consensus-led.

**Vision-led approaches** usually involve an individual political leader (such as a mayor) having a clear view of the future form of city, and pushing through the policy instruments needed to achieve that vision.

**Plan-led approaches** involve: specifying objectives and problems (with problems being defined as failures of current or predicted future conditions to meet the objectives); adopting an ordered procedure identifying possible solutions to those problems; and selecting those which perform best. This procedure will typically involve the use of formal appraisal methods (such as Cost Benefit Analysis or Multi Criteria Analysis), which receive input from computer models which predict the future impacts of alternative policies. An "ideal process" summarising the key aspects of the plan-led approach is given below.

**Consensus-led approaches** involve discussions between the stakeholders to try to reach agreement on each of the stages in formulating a strategy. Ideally agreement is needed on: the objectives to be pursued and their relative importance; the problems to be tackled and their seriousness; the policy instruments to be considered and their appropriateness; the selection of policy instruments which best meet the objective; and the way in which they should be combined into an overall strategy, and implemented. In practice much consensus-building focuses on the choice of policy instruments, but it can be considerably enhanced by considering objectives and problems as well. Clearly, public participation is central to the consensus-led approach. The PROSPECTS DMG identified five different levels of public participation:

- Information provision: a one way process to keep those with an interest in the strategy informed.
- Consultation: where the views of stakeholders and the general public are sought at particular stages of the study and the results are input back into the study process.
- Deciding together: where the stakeholders become decision-makers
- Acting together: where the stakeholders also become involved in the implementation of the strategy.
- Supporting independent stakeholder groups: where the city enables community interest groups to develop their own strategies.

### PITFALLS OF THE DIFFERENT APPROACHES

There are some obvious pitfalls to each approach. A vision-led approach is critically dependent on the individual political leader with the vision. If he or she leaves office, the vision can fade (as has been observed to happen on a number of occasions in the past). A plan-led approach can become unduly dependent on professional planners, who may lose sight of the needs of ordinary citizens, in particular those not associated with powerful groups and who thus cannot make their voices heard. A consensus-led approach may, unless agreement can be reached in a reasonable length of time, lead to unacceptable delay and inaction. In general, the DMG would recommend that a combination of all three approaches should be used, with the precise balance determined by the needs of a given location. This recommendation is clearly aiming to be flexible, and underlies the general attitude of "non-prescription" taken within the DMG. It is worth to mention that a survey of 60 European cities, carried out within PROSPECTS, showed that the majority of cities already adopted a mixed approach, as can be seen in Figure 1.

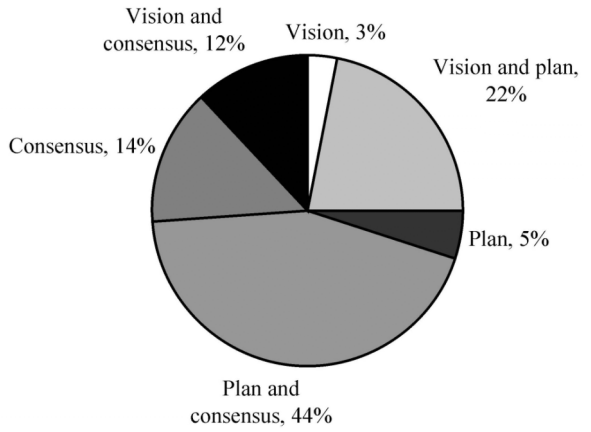


*Figure 1: Approaches adopted in 60 European cities*

### THE "IDEAL PROCESS" IN A PLAN-LED APPROACH

Figure 2 shows the "ideal" decision making process published in the DMG. The suggested "ideal" process contains the following initial steps: (1) a clear definition of objectives and indicators; (2) the explicit definition of problems, at present and in the future; and (3) a specification of possible future scenarios. Subsequent steps involve: (4) the identification of possible instruments to tackle the problems; (5) the assessment of those barriers to implementation which will arise for certain policy instruments; and (6) the development of strategies as packages of instruments that can to reduce the impact of the barriers.

The next steps are concerned with assessment and involve: (7) the use of models to make quantified predictions of the impacts of individual instruments and/or strategies; and (8) a comparison these predictions, using an appraisal method which is consistent with the previously specified objectives. These steps may well identify ways in which the instruments or strategies can be improved, and it is possible at this stage to (9) use optimisation techniques to help identify such improvements.

The final steps in the process occur once a decision has been taken with respect to a particular instrument or strategy: (10) the instrument/strategy is implemented; (11) its performance is assessed against the original objectives (with such assessment potentially helping to improve the predictive process); and (12) the ongoing regular monitoring of the instrument/strategy.

## Transferability to South East Asia

### GENERAL COMMENTS

This section discusses, on a general level, the transferability of the insights contained in the DMG, which, as explained above, were developed within a European context, to South East Asia. As mentioned before there is a wide diversity in the types of decision-making used in Europe, i.e. the balance between plan-led, vision-led, and consensus-led approaches varies greatly between European cities. Thus, there is no standard approach to be considered when analyzing transferability to South East Asia. Nevertheless one of the key factors to take into account when talking about transferability is that South East Asian cities are typically growing much faster (economically and population-wise) than European cities. This leads directly to the following consequences:

1. Plan-led approaches are based heavily around the availability of data and the possibility of making predictions. Inevitably, in fast growth situations, data is less available and detailed predictions are harder to make. Thus there is an argument for weakening those aspects of the plan-led approach that rely heavily upon data and accurate model predictions.
2. On the other hand, fast growth rates can possibly lead to some extremely negative outcomes in terms of the transport system, i.e. more negative than those that might occur in the relatively more stable cities of Europe. In view, of this possibility, plan-led approaches are arguably more important for pre-empting such outcomes in South East Asia than in Europe.
3. The existence of fast growth has the possibility of creating social rupture, particularly given the likelihood that, unless adequate steps are taken, some social groups will benefit heavily from such growth whilst others will only suffer disbenefits. It follows that consensus-led approaches, particularly concerning public participation, are extremely important in fast growth situations. Firstly, public participation is important "in its own right" to ensure a sense of social cohesion. Secondly, public participation can be used to help devise plans to overcome problems faced by the "losers" from fast growth. It immediately follows from the latter consideration that public participation needs to be combined to a certain extent with plan-led approaches (if only to try to ensure that any measures taken to benefit losers are likely to be successful).

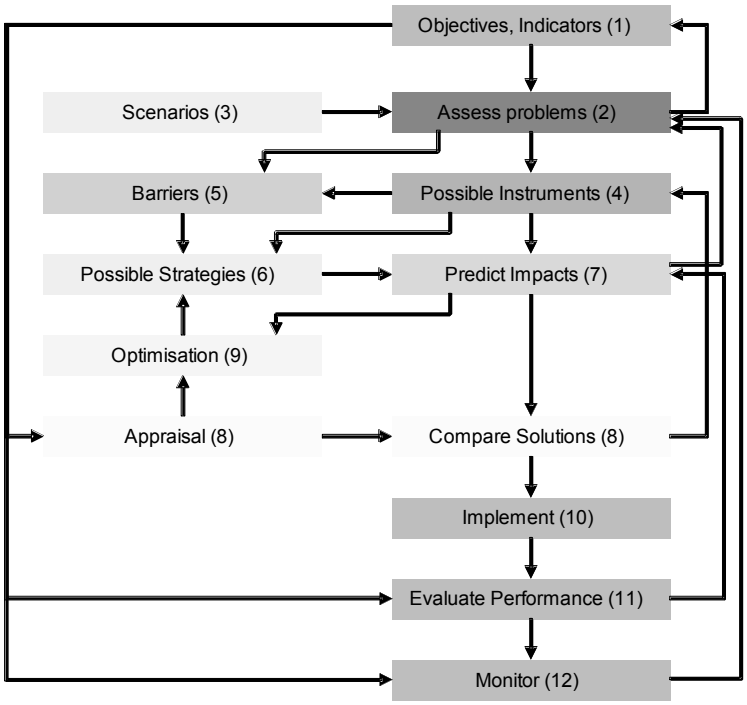


*Figure 2: The "ideal" decision making process introduced in the Decision Makers' Guidebook*

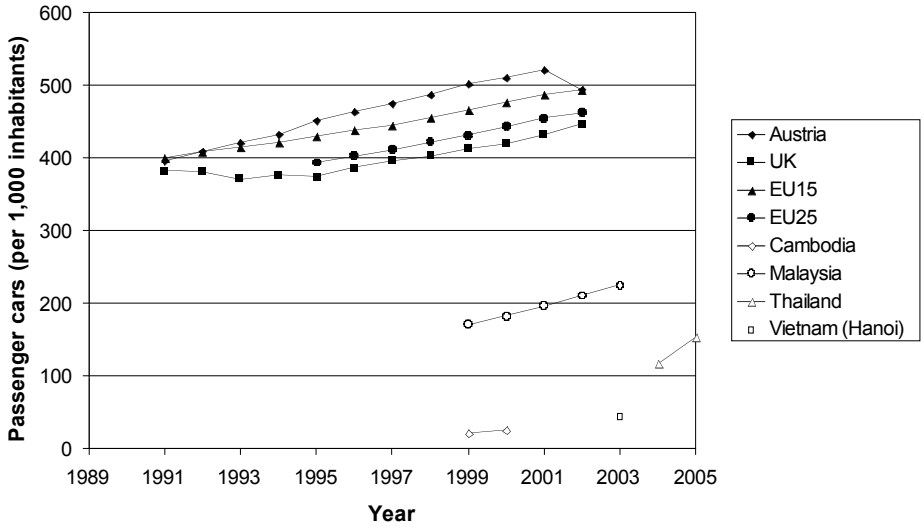


*Figure 3: Comparison of car ownership in Europe and South East Asia. Source: (IRF, 2006), Police department Thailand (2006), (TDSI, 2004), EUROSTAT (http://epp.eurostat.cec.eu.int/)*

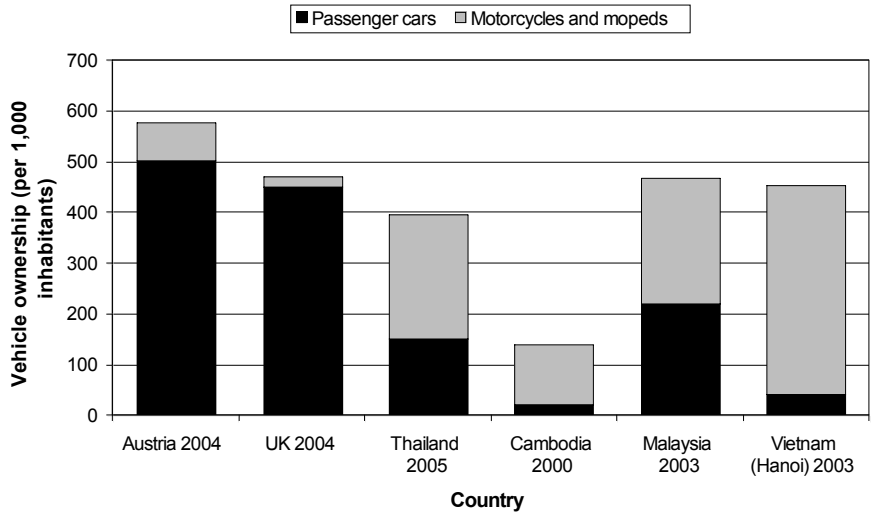


*Figure 4: Comparison of private car ownership and motorcycle/moped ownership in Europe and South East Asia. Source: IRF (2006), Police department Thailand (2006), (TDSI, 2004)*

4. Fast growth and the associated widening of the gap between rich and poor lead to various other consequences which have a direct impact on the urban planning process. On the one hand, the growth in "illegal" settlements by the poor clearly has an impact on the practicality of participation processes, given that the dwellers in these settlements are typically "legally invisible". On the other hand, wealthy members of society might consider that they do not need to conform to planning legislation, and might attempt (frequently successfully) to use bribes to overcome any restrictions put upon them.

At first sight, these considerations would appear to point in different directions with respect to the importance of plan-led approaches in South East Asia. However, when taken together, it can be seen that the importance of such approaches would in general be the same in South East Asia as in Europe: the difference is more concerned with how these approaches should be carried out.

## DIFFERENCES BETWEEN EUROPE AND SOUTH EAST ASIA

Different development trends are taking place in Europe as compared to Asia. For example, in Europe, the population in total will grow very slowly over the next 20 years with an average growth rate of 0.2 % per year. After 2025 it is forecasted that there will occur a decrease of total population with a similar rate. Population growth rates are generally much higher in Asia. For example, in Thailand the growth was 0.4 % per year between 2003 and 2005.

With respect to levels of motorisation, in Europe it is now 460 cars per 1000 inhabitants, with an average annual growth rate of 2.3 % over the period 1995 to 2002, as shown in Figure 3. The total stock of cars in absolute terms increased from 175.6 million cars in the year 1995 to more than 210 million


*Figure 5: Public transport vehicles in Thailand.*


*Figure 6: Different modes using the same road space.*

cars in 2002, comprising an average annual increase of 2.7 %. The motorisation rate in Asia is increasing more rapidly than in Europe, albeit from a much lower base level (e.g. in Thailand it increased 30 % between 2004 to 2005, from 118 cars per 1000 inhabitants in 2004 to 154 cars in 2005, as shown in Figure 3). The most important difference between Europe and Asia is the high availability of motorcycles, as shown in Figure 4. Nevertheless it interesting to notice that in most of the South East Asian countries the overall motorisation rate (cars and motorcycles taken together) has nearly reached the same levels as in Europe.

Differences in means of transport in South East Asia, compared to Europe, can be summarised as follows:

- In Europe, public transport consists of high quality track-based systems (in the larger cities) and bus-based systems (in all cities). Whereas in Asia public transport typically consists of low quality bus/truck services and special forms of para-transit such as Songtaews, Tuk-tuks, Samlors (see Figure 5) and motorcycle taxis. Poor public transport quality increases the attractiveness of car and motorcycle use. Especially motorcycle use is both convenient and cheap. Furthermore, status considerations are very important for high income families, though it is difficult to quantify precisely the extent of their importance.
- Walking trips in South East Asia are considered as unimportant by transport planners and decision makers. Thus insufficient attention is given to this means of transport, in particular with respect to data collection, modelling, policy design and the implementation of measures[1].
- In South East Asia, cycling is rarely used for main purposes of travel, particularly in highly developing countries (e.g. Thailand). Cycling is the domain of students and low income people. In Viet Nam, cycling is noticeably declining and replaced by motorcycling.
- In certain cities Tuk-tuks (used as taxis) may be more important (in the sense of having a higher mode share than walking and cycling.
- There is frequently a high proportion of motorcycles (with a very high mode share in Viet Nam, particularly in the largest cities, i.e. Hanoi[2] and Ho Chi Minh City[3], see Figure 6).

In addition, the utilisation of road infrastructure differs significantly between Europe and South East Asia. Modes with a very different characteristic, like private cars, motorcycles and non-motorised transport modes, are sharing the same road space (Figure 6). Many experts argue that this system is not acceptable because it is too risky and causes too many fatal accidents. The safety argument is used to promote a European style strict separation of modes. However, the few available statistical accident data (IRF, 2006) give a more differentiated picture and do not support this hypothesis (see Figure 7). Clearly countries with an already rather high car ownership rate like Thailand and Malaysia have significantly more fatalities per residents than in the European countries. Countries with low car ownership but high motorcycle ownership rates like Viet Nam are

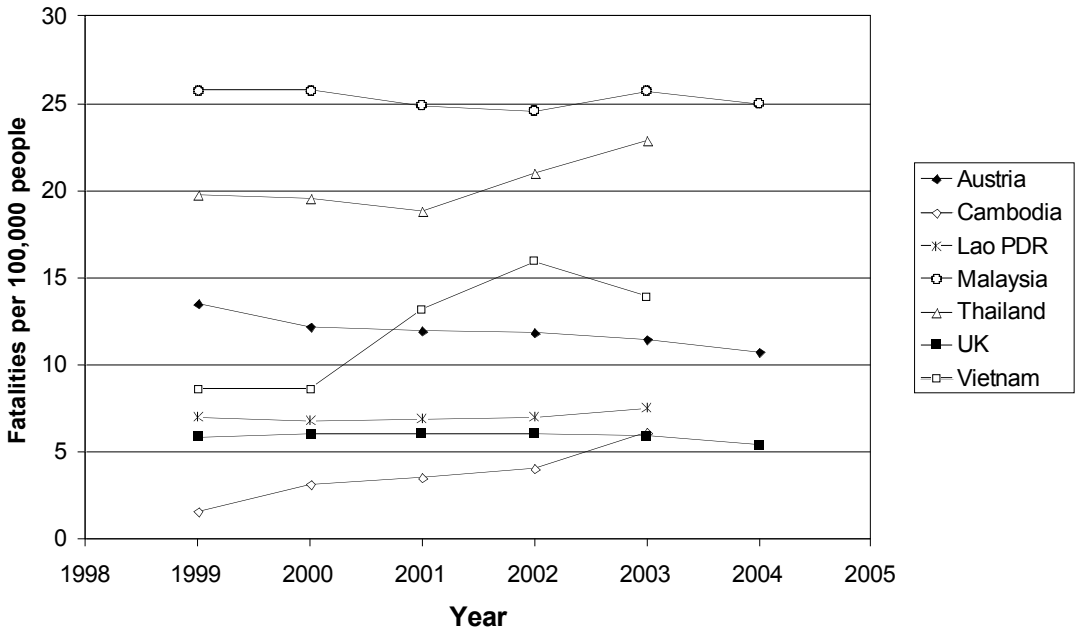


*Figure 7: Fatalities per 100,000 people. Source: (IRF, 2006)*

within the range of the European countries with a poor road safety record. Countries with very low total motorised vehicle ownership like Lao PDR or Cambodia are even within the range of the best performing European countries. Additionally the differences in the available emergency and medical services explain a great part of the differences in fatality rates. Unfortunately there are no specific accident statistics available for the urban areas. From experience gained in the SPARKLE workshops we can conclude that, as long as speed is low due to the high density of inner-city traffic, the accident risk is rather low. The situation is different concerning inter-city traffic. Especially old, poorly serviced and overloaded trucks with overtired drivers seem to impose a severe risk especially to people living nearby the roads.

From a system point of view, South East Asian urban transport systems are very efficient: the relatively low speed level (below 25 km/h) allows a high throughput, the system is very space efficient and is working with few rules (highly self-organising); and the transport system fits very well with the urban densities existing in South East Asian cities. During the SPARKLE seminar in Ho Chi Minh City in March 2006 we have performed a short peak period traffic count at a typical two-lane road section. The traffic volumes extrapolated to one hour are nearly 18,000 vehicles per hour (150 cars, 1,800 bicycles and 16,000 motorcycles) or about 23,000 persons per hour. The counted vehicle occupancy rates were about 4 persons per car, 1.2 person per bicycle and 1.3 persons per motorcycle. (Derstroff and Rossmark, 2005) have counted similar traffic volumes at a two-lane, radial road in Hanoi. Their counts result in about 13,000 motorcycles and 1,000 cars or 25,000 people per hour. The Highway Capacity Manual (HCM, 2000) cites a capacity of about 2,200 cars per hour and lane. In combination with a car occupancy rate of about 1.2 persons per car typical for Europe this results for a two-lane road in a capacity of about 5,300 persons per hour. I.e. the densities are much higher in South East Asian cities than in European cities and therefore from the point of view of land consumption the transport system in South East Asia is much more efficient than in Europe.

## ELEMENTS OF THE "IDEAL" PLAN-LED PROCESS

The four elements objectives, policy instruments, barriers and strategies of the process introduced in Figure 2 are discussed in more detail below. The reasons for selecting these elements are:

1. from the discussions during the two seminars and eight workshops in Thailand, Viet Nam, Cambodia and Laos, the these four issues were found to be the weakest in the planning processes in these countries; and
2. the other elements in the planning process (such as monitoring, evaluation, assessment and optimisation) are more concerned with technical methodology, and therefore raise different questions with respect to transferability.

### Objectives

In developing a land use and transport strategy, it is essential to be clear what the strategy is designed to achieve. Objectives are broad statements of the improvements which a city is seeking in its land use and transport system. It is important that decision-makers and other stakeholders determine (preferably through a public participation process) the objectives which they wish to pursue. Relating to the overall objective of sustainability, seven sub-objectives are suggested in the DMG, including protection of the environment, liveable streets and neighbourhoods, safety, equity and social inclusion, economic efficiency, contribution to economic growth, and intergenerational equity. Usually it is not possible to satisfy all of the objectives which may be desirable, as some of them will conflict; for example it is often difficult to improve economic growth

**Table 1: Current priority of objectives in South East Asian and European cities**

| Objectives | Priority | | |
|---|---|---|---|
| | High | Medium | Low |
| Economic efficiency | **√ x X** | | |
| Protection of the environment | | **x X** | **√** |
| Liveable streets and neighbourhoods | | **√ x X** | |
| Safety | **x** | **√ X** | |
| Equity and social inclusion | | **x** | **√ X** |
| Contribution to economic growth | **√ x X** | | |
| Intergenerational equity | | | **√ x X** |

Legend:
√ South East Asian cities (results of SPARKLE seminars and workshops)
x European cities from the PROSPECTS survey (Matthews and May, 2001)
X PROSPECTS core cities (Edinburgh, Helsinki, Madrid, Oslo, Stockholm, Vienna) (Matthews and May, 2001)

**Table 2: Policy instruments currently used in South East Asian and European cities**

| Policy | Level of use | | |
|---|---|---|---|
| | High | Medium | Low |
| Land use measures | **x** | **√ X** | |
| Infrastructure provision | **√ (Car) X (Rail)** | | **x (Rail)** |
| Management of the infrastructure | **√ (Car) x (PT)** | **X (PT)** | |
| Information provision | | **x** | **√ X** |
| Attitudinal and behavioural measures | | **√ (Safety) x** | **X** |
| Pricing | | **x** | **√ X** |

Legend:
√ South East Asian cities (results of SPARKLE seminars and workshops)
x European cities from the PROSPECTS survey (Matthews and May, 2001)
X PROSPECTS core cities (Edinburgh, Helsinki, Madrid, Oslo, Stockholm, Vienna) (Matthews and May, 2001)

without intruding into the environment. Therefore, priorities between objectives are important.

Many South East Asian cities currently focus only on economic efficiency and growth, with much less concern for environment and equity (Table 1[4]). This leads to strategies which prioritise policy instruments relating to road infrastructure provision. It follows that if objectives are set inappropriately (they are unbalanced), a designed strategy cannot achieve the overall objective of sustainability. In addition, some cities in South East Asia add a new objective concerning the protection of local culture. This is implicitly included in the DMG as part of protection of the environment, but does not receive a high profile.

In general a rather high conformity between the priorities of objectives in the South East Asian and European cities was observed. The most significant difference is that the South East Asian cities put less emphasis on protecting the environment than their European counterparts.

### Policy instruments

Policy instruments are the tools which can be used to overcome problems and achieve objectives. There are a number of instruments, which can be categorized by their type of intervention: land use measures; infrastructure provision; management of the infrastructure; information provision; attitudinal and behavioural measures; and pricing. Table 2[4] shows which types of policy instruments South East Asian and European cities currently have chosen to use. It is often difficult to determine how a city to choose the policy instruments in use. Frequently, proposals for policy instruments such as road schemes have a long history (i.e. they have been included in many plans in the past even though they have not been implemented). Thus, whenever a "new" strategy is developed, it is likely to include these old schemes. As a result, alternative instruments are much less utilised. As an alternative approach, the DMG suggests that it is much more valuable to start with a clean sheet, considering the full range of policy instruments available, and deciding which are likely to contribute most. In short, it is far better to start with the question "Which of this list of policy instruments should I consider?" rather than "How best can I make use of earlier proposals?".

Again there is some kind of conformity between the decisions in South East Asian and European cities. Especially both tend to favour policies of the type infrastructure provision and management. Although there is a difference insofar as the focus in Europe is more on public transport (especially rail) infrastructure than on road infrastructure.

### Barriers

A barrier is an obstacle that prevents the coming-into-force of a particular instrument, or causes delays in its implementation. Barriers may lead to certain policy instruments being overlooked, and the resulting strategies being much less effective. For example, cities may be tempted to reject demand management measures simply because they are unpopular, although they are very likely to be an important part of a strategy. Barriers can be rigid or flexible. The former are more difficult

**Table 3: Key elements of strategy currently used in South East Asian cities**

| Key elements | Level of consideration | | |
|---|---|---|---|
| | High | Medium | Low |
| Reducing need to travel | | | √ X |
| Reducing car use | | X | √ |
| Improving public transport | | √ X | |
| Improving road network | √ | | X |

Legend:
√ South East Asian cities (results of SPARKLE seminars and workshops)
X European cities from the PROSPECTS (Matthews and May, 2001; Minken et al., 2003)

to overcome than the latter. In South East Asia, rigid barriers include:

- Barriers from political systems and decision makers (politicians). Such barriers relate to the political and public acceptance of instruments, and are tied closely to the political system in operation in a particular context. Since political systems vary between Europe and South East Asia, there will inevitably be differences in the types of political barrier found in the two regions.
- Barriers from private vehicle-oriented cities. During the last few decades, Asian cities have increasingly been building infrastructure for car use. For example in Bangkok, there are over 200 kilometres of expressways, and the main roads usually have at least 4 lanes in each direction. This provides a major obstacle for public transport improvement, and for the encouragement of non-motorised transport. These barriers are a result of a 'wrong' approach to decision making.
- Barriers from people's behaviours and habits. When road infrastructure is provided, travellers get accustomed to using it, either enjoying driving their cars or being forced to use their cars because of poor public transport provision.

Some flexible barriers which are similar to barriers in European cities (May et al., 2005) include:

- Legislation and institutional barriers. These include lack of legal powers to implement a particular instrument, and legal responsibilities which are split between agencies, limiting the ability of the city authority to implement the affected instrument.
- Financial barriers. These include budget restrictions limiting the overall expenditure on the strategy, financial restrictions on specific instruments, and limitations on the flexibility with which revenues can be used to finance the full range of instruments.
- Practical and technological barriers. For land use and infrastructure these may well include land acquisition. For management and pricing, enforcement and administration are key issues. For infrastructure, management and information systems, engineering design and availability of technology may limit progress. Generally, lack of key skills and expertise can be a significant barrier to progress,

In South East Asia, these flexible barriers are highly interrelated with the political system: if the political system is set up appropriately, these barriers are not difficult to overcome. As one of the participants mentioned in one of the SPARKLE workshops: "*transport is not a technical, but a political issue*".

#### Strategies

There is no one solution to urban transport problems. Thus, there is a need to develop a transport and land use strategy that consists of a combination of policy instruments. This approach is very likely to be more effective than selecting any one instrument. In these ways we can achieve synergy between instruments (i.e. the overall benefits are greater then the sum of the parts), and can overcome barriers.

According to the DMG, there are four key elements to any strategy, including: reducing need to travel, reducing car use, improving public transport, and improving road network. The strategy should contain instruments to address all four of these elements, and a key element of an integrated strategy is the determination of the way in which these elements are integrated, and the balance between them determined.

Table 3 summarises the type of strategies currently used in South East Asia. It can be seen that improving the road network for car use has been taken as the first priority for a few decades (as was shown in Table 2). Currently, though, there is an increasing interest in improving public transport. However, there is less consideration of reducing car use and the need to travel, due to political barriers (as mentioned above).

## Links and interaction between decision making and transport energy consumption

### THE ROLE OF ENERGY CONSUMPTION IN THE DECISION MAKING PROCESS

Consumption of energy and especially fossil fuels relates to at least four of the seven sub-objectives shown in Table 1: economic efficiency, protection of the environment, contribution to economic growth and intergenerational equity. For three of them (economic efficiency, protection of the environment and intergenerational equity) a reduction of non renewable energy consumption directly relates to their goal achievement. If less energy is necessary to produce a certain economic output then economic efficiency will increase. If less fossil fuel is burnt then less emissions will harm the environment. If less non renewable resources are consumed today then the future generations will have more opportunities. The situation is a bit ambiguous for the forth sub-objective. In today's economy the energy is essential for economic growth[5]. Therefore in today's logic an increase in energy consumption would contribute to the goal

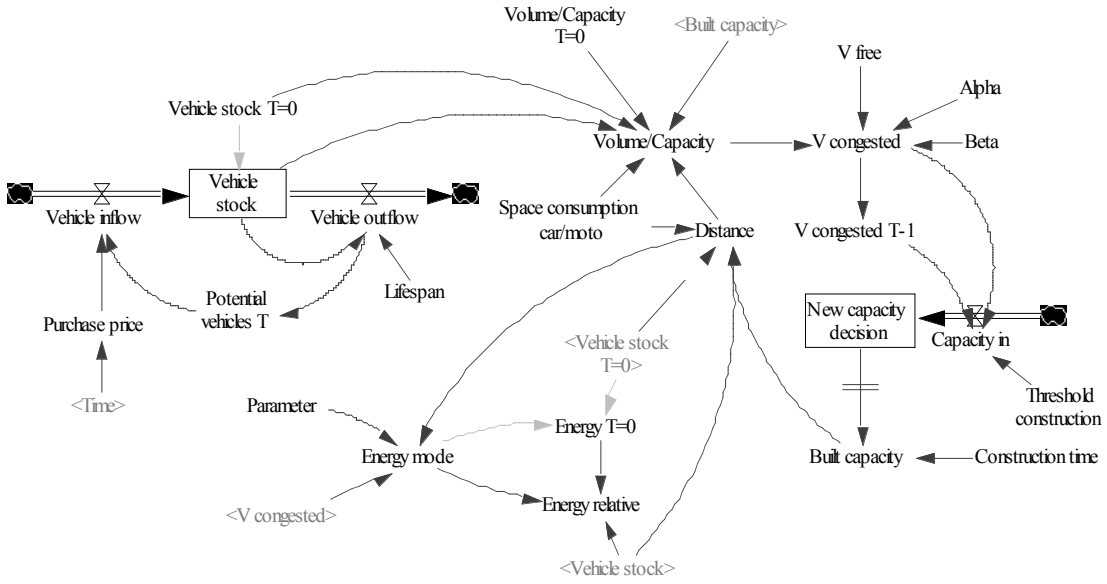


*Figure 8: Model of the effects of the Vietnamese WTO accession.*

achievement of this sub-objective. But on the other hand most of countries are only fossil fuel consumers and not producers. Therefore their consumption imposes costs on their economy and increases their dependence on others. From all this it can be concluded that the reduction of (non renewable) energy consumption should be an objective in its own right in the decision making process.

It is seen as uncertain by many experts that the energy supply of the future can keep pace with the demand. There is a rather high probability that the world will experience scarcity of oil in the near to mid term future (Monzon and Nuijten, 2006). Therefore energy supply has to be part of the scenarios used in the decision making process.

Possible instruments might either have direct or indirect effects on energy consumption. Nevertheless most of instruments within the policy areas mentioned in Table 2 will have indirect effects. Land use measures might change the density of origins and destinations. This might change distances travelled and hence the energy consumed. Infrastructure provision and management might (at least in the short term) reduce congestion and increase travel speed. This affects the energy consumption in two ways. First the changing speed influences the specific energy consumption of motorcycles and cars. Secondly it makes motorised modes more attractive which increases its utilisation, distance travelled and energy consumed. Information provision and attitudinal and behavioural measures influence (at least in the short term) the behaviour of people. They might e.g. choose public transport instead of individual motorised transport and hence reduce energy consumption. Pricing might make individual motorised modes less attractive which decreases its utilisation, distance travelled and energy consumed.

Finally it is crucial that energy consumption is used as a key indicator in the performance evaluation and monitoring stage of the decision making process.

## CASE STUDY VIETNAMESE WTO ACCESSION

### Background

This short case study will investigate the effects of a national policy in an urban region. On the 11th of March 2007 Viet Nam was accepted as the 150th member of the World Trade Organisation WTO (Mei, 2007). One of the effects of the WTO accession is that Viet Nam has to reduce or even abolish customs duties. Before the WTO membership purchase prices for cars have been even higher than in Europe due to duties and taxes. Therefore private car ownership was very low. According to information from colleagues at TDSI in Hanoi Chinese car manufacturers are now ready to export cars to Viet Nam for about 7,000 to 8,000 US $. This is slightly more than twice the actual price of a decent motorcycle.

### The Systems Dynamics model of Hanoi

A simple Systems Dynamics model was set up to investigate the effects of the WTO accession of Viet Nam[6]. Figure 8 shows the basic structure of the simulation model. We start with a vehicle stock of 412 motorcycles and 43 car per 1,000 residents in year 0 (TDSI, 2004). Each year a certain share of the stock reaches its lifespan and is replaced. The decision whether to purchase a car or a motorcycle is modelled using the analogy to Kirchhoff's 2nd law from electrical engineering. In this model the purchase price represents the resistance to buy a vehicle. The total stock of motorcycles plus cars is assumed to be constant. The calibration to the current vehicle stock results in a price of 25,000 US $ for a car. The price of a motorcycle is estimated with 2,500 US $. The customs duties will be completely abolished in year 7 thus reducing the price of a new car to 7,500 US $. Cars consume more space than motorcycles. Thus more cars on the road will decrease the average travel speed. It was assumed that at low speeds four motorcycles occupy the same space as one car. If congestion gets worse then the decision makers will react and construct new road infrastructure. The time lag between the decision to build and the completion

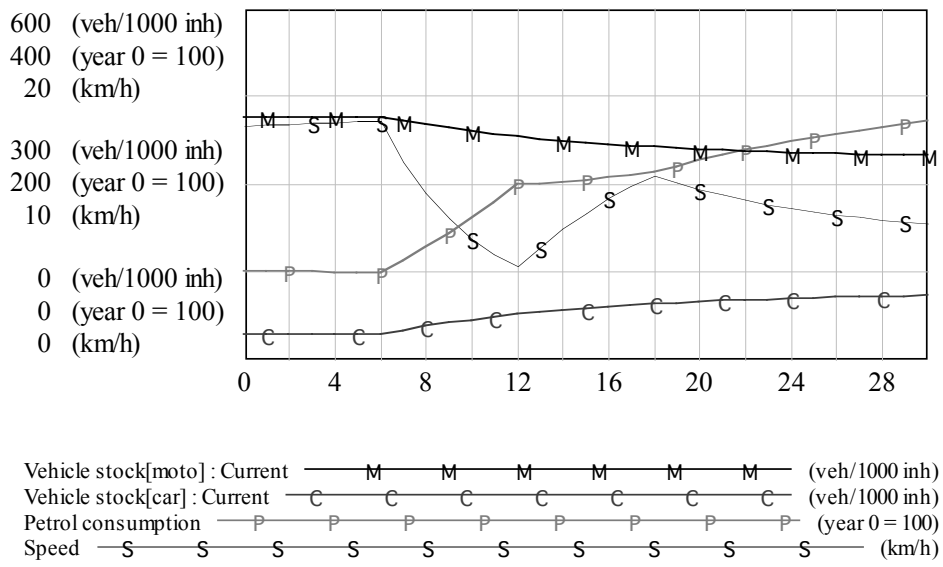


*Figure 9: Development of vehicle stock and petrol consumption Vietnamese WTO accession.*

is estimated with five years. New infrastructure needs space and hence reduces densities and increases travel distances. Speed dependent emission factors (DMRB, 2003) and the changes in speed and distance are used to calculate the energy consumption relative to the base year.

#### Results

Figure 9 summarises the development of the vehicle stock and the relative energy consumption over 30 years. The process of replacing motorcycles by the then relatively cheap cars starts in year 7. The model predicts that car ownership in the long term will increase to about 110 cars per 1,000 inhabitants while motorcycle ownership will decrease to about 350 motorcycles per 1,000 inhabitants. The energy consumption increases steeply from year 6 onwards. This is caused by two effects. On the one hand the specific fuel consumption of cars is higher than that of motorcycles and on the other hand increasing congestion increases the specific fuel consumption of both motorcycles and cars. The first additional road infrastructure is ready to be used in year 12. Thus increasing speeds decrease the specific energy consumption. But after 6 years speed decrease again and never reach the levels of the base year again. 25 years after the abolishment of the customs duties the fuel consumption has increased by about 170 %.

## Summary

From our findings we can conclude that the "ideal decision making process" as developed in the European context is in principle applicable to South East Asian cities[7]. Notwithstanding, it must be emphasised that such an "ideal process" is, in most cases, not fully implemented in European cities. Compromises and adaptations have to be made to meet local circumstances in both regions. The non-prescriptive design of the "ideal decision making process" exactly allows this. Four elements within the "ideal process" have been highlighted in this paper with respect to their transferability between Europe and South East Asia: objectives, policy instruments, barriers and strategies. Concerning these elements we have observed a certain consistency between Europe and South East Asia.

Regarding objectives the most significant difference is that the South East Asian cities put less emphasis on protecting the environment than their European counterparts. Also safety and equity and social inclusion are rated slightly higher by the European cities. Given the current situation of the South East countries it is understandable that they put more emphasis on economy than the environment. But the earlier environmental issues are considered in their economic development process the better they will be off in the long term. The concept of sustainability and hence the objective of intergenerational equity is rated very low in both Europe and South East Asia. Public participation is an important instrument to define public acceptable objectives, in particular within a process of open discussion between all stakeholder groups (local population, environmentalists, transport planers, politicians).

On the subject of policy instruments the most distinct difference is that while most cities in Europe focus on public transport infrastructure South East Asian cities focus on road infrastructure. The present set of policy instruments used in South East Asian cities is rather narrowly focused upon infrastructure provision and management for car users and clearly should be extended to the other modes. Mass transport and the promotion of non-motorised modes need to be given more weight in order to solve present and future transport challenges. In particular, the promotion of non-motorised modes would be greatly enhanced through the provision of information concerning the advantages of "slow" modes in the context of the highly populated urban areas in South East Asia.

Most of the barriers of implementation are inter-related with the political system and have a long history. However, if the concept of sustainability becomes socially well-entrenched, such (rigid) barriers can eventually be overcome. As described in detail in the DMG, combinations of policy instruments

(strategies) can be used to overcome certain barriers by compensating potential losers (with respect to any new scheme). These strategies need to be formed in a way so that objectives can be met by minimising the unavoidable negative impacts for some stakeholder groups. For example if the improvement of public transport involves financial difficulties (barriers), a road pricing scheme may help provide the solution. The most significant difference about strategies is that South East Asian cities put a high weight on improving the road network while the European cities have recognised that this would not solve urban problems and put more emphasis on the reduction of car use.

It is possible to identify several important interrelations between the decision making process and transport energy consumption. Firstly energy consumption influences several sub-objectives of the "ideal decision making process" namely economic efficiency, protection of the environment, contribution to economic growth and intergenerational equity. A reduction of energy consumption influences three of them undoubtedly in the direction of goal achievement. Only for the objective contribution to economic growth a reduction of energy consumption might have ambiguous effects. We conclude that the reduction of energy consumption should be an objective in its own right. Furthermore energy consumption plays an important role in scenario definition and performance evaluation and monitoring.

In a brief case study we have tested which effects the national policy of the WTO accession will have on the transport energy consumption of the city of Hanoi. For this purpose we have built a Systems Dynamics model including vehicle stock development, congestion and speed flow relationship, road capacity building, urban sprawl and fuel consumption. The main results of this case study are that car ownership will increase by about 250 % in 25 years and fuel consumption will increase by about 170 % during the same period. It has to be mentioned that the model assumption are very conservative. Therefore this can be seen as a lower limit of future developments. For future research we propose to develop a more detailed model to investigate this is issue in depth.

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## Glossary

| | |
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| DMG | **D**ecision **M**akers **G**uidebook |
| EUROSTAT | Statistical Office of the European Communities; http://epp.eurostat.cec.eu.int/ |
| LUTI | **L**and **U**se and **T**ransport **I**nteraction model |
| MARS | **M**etropolitan **A**ctivity **R**elocation **S**imulator; a land use and transport interaction model developed at Vienna University of Technology, Institute for Transport Planning and Traffic Engineering |
| PLUME | **PL**anning **U**rban **M**obility in **E**urope; http://www.lutr.net/index.asp |
| PROSPECTS | **P**rocedures for **R**ecommending **O**ptimal **S**ustainable **P**lanning of **E**uropean **C**ity Transport **S**ystems; http://www.ivv.tuwien.ac.at/?id=2550 |
| SPARKLE | **S**ustainability **P**lanning for **A**sian cities making use of **R**esearch, **K**now-how and **L**essons from **E**urope; http://www.ivv.tuwien.ac.at/?id=1746 |

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| STEPS | **S**cenarios for the **T**ransport system and the **E**nergy supply and their **P**otential effect**S**, www.ivv.tuwien.ac.at/index.php?id=1674 |
| TDSI | Transport Development and Strategy Institute, Ministry of Transport, Viet Nam |
| WTO | World Trade Organisation; http://www.wto.org |

## Acknowledgments

The research reported here was funded by the European Commission. We are grateful to colleagues working on the several projects for their contributions to the ideas presented here, and particularly to Ms. Le Thi Kim Long, Ms. Nguyen Thi Phuong Hien from Transport Development and Strategy Institute (TDSI), Hanoi, Viet Nam and Mr. Nguyen Hai Bang from Transport Sustainable Development and Environment Research Institute (TERI), Hanoi, Viet Nam. The proposals are, however, the responsibility of the authors.

## Endnotes

[1] E.g. Kep Chuk Tema, governor of the city of Phnom Penh, Cambodia: "I want that all the pavements in Phnom Penh become smaller. The people here use cars and motorcycles. We do not like to walk." Own translation, original in German: "Ich will, dass alle Gehwege in Phnom Penh immer schmaler (sic!) werden,... die Menschen hier nutzen Autos und Motorräder. Wir laufen nicht gerne." Hollmann, N. (2006). "Der Kambodschaner läuft nicht gern – Stadtentwicklung und Verkehrsplanung in Phnom Penh." Internationales Verkehrswesen 58 (10), 490-491. Nevertheless it has to be noted that, although significant improvements have been made in some cities such as Vienna, Zurich and Karlsruhe, in many European cities transport planers and city authorities still do not give sufficient recognition to walking and cycling.

[2] The share of motorcycles in Hanoi is about 42 % of all trips or 81 % of all motorised trips. Schipper, L., Huizenga, C., and Ng, W. (2005), "Indicators: Reliable signposts on the road to sustainable transportation - The partnership for sustainable transport in Asia." eceee 2005 Summer Study Proceedings, Mandelieu, France.

[3] The share of motorcycles in Ho Chi Minh city is about 90 % of all motorised trips.JICA, MOT, and HCMC-PC. (2004). "The Study on Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area - HOUTRANS." Japan International Cooperation Agency (JICA), Ministry of Transport, Socialist Republic of Vietnam (MOT) and Ho Chi Minh City People's Committee (HCMC-PC), Hanoi. www.houtrans.org,

[4] The survey cities are representative of all city sizes in Europe, and include approximately 25 % small cities (<100,000 residents) and also many medium size cities (<250,000). On the other hand, the core cities in the PROSPECTS project all had more than 500,000 inhabitants.

[5] It has to be mentioned that there is doubt that "economic growth" at all should be a sub-objective of sustainability.

[6] The commercial software Vensim® from Ventana Systems, Inc. (http://www.vensim.com/) was used to build this model.

[7] At least as far as the four countries Cambodia, Lao PDR, Thailand and Viet Nam which we have analysed in detail within the project SPARKLE are concerned.